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NEW

# Watts to see...

## Big LCD, Big 45 W, Big 21 memories, compact.

# TR-7950/7930

**Outstanding features providing maximum ease of operation include a large, easy-to-read (direct sunlight or dark) LCD display, 21 multi-function memories, automatic offset, programmable priority channel, memory and band scans, built-in lithium battery memory back-up, built-in 16-key autopatch encoder, and a choice of a hefty 45 watts output (TR-7950), or 25 watts output (TR-7930).**

### TR-7950/TR-7930 FEATURES:

- **NEW, large, easy-to-read LCD digital display**
  Easy to read in direct sunlight or dark (back-lighted). Displays transmit/receive frequencies, memory channel, repeater offset, (+,S,−), sub-tone number (F-0, 1, 2, 3), tone, scan, and memory scan lock-out. Includes LED S/RF bar meter, and LED indicators for REVERSE, CENTER TUNING, PRIORITY, and ON AIR.
- **21 NEW, multi-function memory channels**
  Stores frequency, repeater offset, and optional sub-tone channels. Memories 1 through 15 for simplex or ± 600 kHz offset. Memory pairs 16/17, and 18/19 are paired for non-standard repeater offset. Memories "A" and "B" set upper and lower scan limits, or for simplex or ± 600 kHz offset. In MEMORY mode, a circle of light appears around the memory selector knob. When the memory selector knob is rotated in either direction to channel 1, an audible "beep" will sound.
- **Choice of 45 or 25 watts output**
  The TR-7950 provides a hefty 45 watts output, while the TR-7930 features a more modest 25 watts. A HI/LOW power switch allows power reduction to approx. 5 watts.
- **Long-life lithium battery memory back-up**
  Built-in lithium battery has an estimated 5 year life.
- **Automatic offset**
  The microprocessor is pre-programmed for simplex or ± 600 kHz offset, in accordance with the 2 meter band plan. "OS" key allows manual change in offset.
- **Programmable priority alert**
  The PRIORITY channel may be programmed in any of the 21 memories. With ALERT switch "ON," a dual "beep" sounds when a signal is present on the PRIORITY channel. An OPER switch allows an easy move to the PRIORITY channel.
- **Programmable memory scan lock-out**
  "LO" key for programming scan to skip selected memory channels, without erasing the memory.
- **Programmable band-scan width**
  The lower limit may be programmed into memory "A," and the upper limit into memory "B."
- **Center stop during band-scan, with indicator**
  Stops in center of channel during band-scan, with center tuning indicator.
- **Scan resume selectable**
  Scan stops on busy channel. Selectable automatic time resume-scan (approx. 5 sec., adjustable), or carrier operated resume-scan. A scan delay of approx. 1.5 seconds built-in.
- **Scan control using up/down microphone**
  Momentarily pressing UP or DOWN button on microphone tunes one step in the selected direction, on memory or on 5-kHz step tuning. Holding the button for about 2 seconds starts UP or DOWN automatic scan action. Scan start also possible using "SC" key on keyboard. Scan may be cancelled by momentarily pressing the PTT switch, or by pressing both UP/DOWN buttons simultaneously.
- **Programmable sub-tone channels**
  Optional TU-79 3 frequency sub-tone unit provides keyboard selectable sub-tone channels, which may be stored in memory.
- **Built-in 16-key autopatch, with monitor**
  The keyboard functions as a 16-key autopatch encoder during transmit. DTMF tones appear in the speaker output when a key is pressed during transmit.
- **Front panel keyboard control**
  Used for selecting frequency, offset, programming memories, controlling scan, and autopatch encode. Keyboard lighting is provided.
- **Extended frequency coverage**
  Covers 142.000-148.995 MHz, in 5-kHz steps.
- **Repeater reverse switch**
  Locking-type switch, with indicator.
- **"Beeper" amplified through speaker**
- **Compact, lightweight design**
- **Easy-to-install adjustable-angle mobile mounting bracket**

**Optional accessories:**

- TU-79 three frequency tone unit.
- KPS-12 fixed-station power supply for TR-7950.
- KPS-7A fixed-station power supply for TR-7930.
- SP-40 compact mobile speaker.

More information on the TR-7950 and TR-7930 is available from all authorized dealers of Trio-Kenwood Communications, 1111 West Walnut Street, Compton, California 90220.

KENWOOD

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*Specifications and prices are subject to change without notice or obligation.*

# TS-830S

## "Top-notch"...VBT, notch, IF shift, wide dynamic range

**The TS-830S has every conceivable operating feature built-in for 160-10 meters (including the three new bands). It combines a high dynamic range with variable bandwidth tuning (VBT), IF shift, and an IF notch filter, as well as very sharp filters in the 455-kHz second IF.**

**TS-830S FEATURES:**

- LSB, USB, and CW on 160-10 meters, including the new 10, 18, and 24-MHz bands. Receives WWV on 10 MHz.
- Wide receiver dynamic range. Junction FETs in the balanced mixer, MOSFET RF amplifier at low level, and dual resonator for each band.
- Variable bandwidth tuning (VBT). Varies IF filter passband width.
- Notch filter high-Q active circuit in 455-kHz second IF.
- IF shift (passband tuning).
- Noise-blanker threshold level control.
- Built-in digital display, (fluorescent tube), with analog dial.
- 6146B final with RF negative feedback. Runs 220 W PEP (SSB)/180 W DC (CW) input on all bands.
- Built-in RF speech processor.
- Narrow/wide filter selection on CW.
- SSB monitor circuit.
- RIT and XIT (transmitter incremental tuning).

**Optional accessories:**

- SP-230 external speaker.
- VFO-230 external digital VFO with five memories, digital display.
- VFO-240 external analog VFO.
- AT-230 antenna tuner.
- YG-455C (500 Hz) or YG-455CN (250 Hz) CW filter for 455 kHz IF.
- YK-88C (500 Hz) or YK-88CN (270 Hz) CW filter for 8.83 MHz IF.
- KB-1 deluxe heavyweight knob.

# TS-530S

## "Cents-ational"...IF shift, digital display, narrow-wide filter switch

**The TS-530S SSB/CW transceiver covers 160-10 meters using the latest, most advanced circuit technology, yet at an affordable price.**

**TS-530S FEATURES:**

- 160-10 meters, LSB, USB, CW, all amateur frequencies, including new 10, 18, and 24 MHz bands. Receives WWV on 10 MHz.
- IF shift tunes out interfering signals.
- Built-in digital display (six digits, fluorescent tubes), with analog dial.
- Narrow/wide filter selector switch for CW and/or SSB.
- Built-in speech processor, for increased talk power.
- Wide receiver dynamic range, with greater immunity to overload.
- Two 6146B's in final, allows 220W PEP/180 W DC input on all bands.
- Advanced single-conversion PLL, for better stability, improved spurious characteristics.
- Adjustable noise-blanker, with front panel threshold control.
- RIT/XIT front panel control allows independent fine-tuning of receive or transmit frequencies.

**Optional accessories:**

- SP-230 external speaker with selectable audio filters.
- VFO-240 remote analog VFO.
- VFO-230 remote digital VFO.
- AT-230 antenna tuner/SWR/power meter.
- MC-50 desk microphone
- KB-1 deluxe VFO knob.
- YK-88C (500 Hz) or YK-88CN (270 Hz) CW filter.
- YK-88SN (1.8 kHz) narrow SSB filter.

# TS-660

**The TS-660 "QUAD BANDER" covers 6, 10, 12, 15 meters.**

- FM, SSB (USB), CW, and AM
- Dual digital VFO's
- Digital display
- IF shift built-in
- 5 memories with memory scan
- UP/DOWN microphone
- All-mode squelch
- Noise blanker
- CW semi break-in/sidetone
- 10 W on SSB, CW, FM; 4 W on AM.

**Optional accessories:**

- PS-20 power supply
- VOX-4 speech processor/VOX
- SP-120 External speaker
- MB-100 Mobile mount
- YK-88C, YK-88CN CW filters
- YK-88A AM filter.

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**HL-32V**—This Little Beauty is the first of our compact, low profile amplifiers for use with handheld radios. For VHF operations, this unit produces 10W to 25W output with drive from your 0.5W to 3W handheld. Excellent for mobile use in your car.

Turn it on with the convenient front panel controls, including Power LED and Transmit LED, or slip the package under the seat out of sight and out of mind.

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The HL-32V operates linear mode for SSB or FM (switch selected), and the best news of all: the price is only $89.95 suggested retail! At your favorite dealer now!

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# CQ The Radio Amateur's Journal

**ON THE COVER:** Once again a scene from CQ's winter wonderland via the talents of John Rogers, W2ADC. For the past three years John has delighted us with various views of CQville during the holidays.


**DECEMBER 1982** **VOL. 38, NO. 12**


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# Zero Bias

AN EDITORIAL

Our cover this month is another view of *CQ*ville (as we call it) by noted watercolorist John Rogers, W2ADC. The admixture of Baldwin earphones and brass key with a modern transceiver and microphone spans the years in this peaceful *ham*let. You can almost feel the warm glow of the room, sit in that familiar oak office chair, and look out at the newly fallen snow. There is the transitional feeling of old to new, not only with equipment, but with the season, too. Holidays are coming and a new year will soon be upon us. Some traditions, like equipment, are certainly worth keeping and treasuring, and others must change with the time.

Each of us here has mused ourselves into that chair during the few weeks that the painting has been here; we've imagined the squeaky casters (that will fall off if you move the chair too fast) and given in to the holiday reverie. All of us at *CQ* hope you capture that same feeling during this season and that your holidays are just as warm and inviting. Most of all, we'd like to thank you for making it possible for our third December issue with you to be the biggest and best yet. Seasons greetings and a very Happy New Year to all.

## Travels With CQ

The last few months of the year seem to be jam packed with amateur activities. Contests notwithstanding, there is a hamfest or convention almost each and every weekend. Despite our burdened economy, attendance at these events is definitely on the increase. There is an optimistic feeling among the attendees, and it is quite obvious that a lot of folks who come out to a hamfest do go home with one or two pieces of new equipment. That's not to say that amateur radio and the amateur radio industry do not feel the everyday pinch of today's times. My observation of the situation (based on our attendance at a lot of shows) indicates that the amateur as a consumer is still willing to buy new gear. The only thing different is that we're probably a "harder sell" and need a little more convincing or selling and good old customer service to help us make up our minds. I see what the dealers bring in to the exhibit areas, and I see how much they take home with them. The dealers who attend shows on a regular basis and go that extra little bit to help a customer generally sell most of what they bring. Let's face it: even in the best of times we hams are almost impossible to deal with.

On September 23rd, Dick and I went (via St. Louis) to Urbana, Illinois, to visit the new plant of HAL Communications Corp. Jack and I had been to the older plant about two or three years ago. The new facilities are much larger and were specifically designed for HAL. We toured the plant and watched equipment being made, tested, and shipped. I even managed to scrounge up a few pieces of aluminum in their shop for one of my own projects. The next day Dick and I drove up to Mundelein, Illinois, with Bill Henry and Ken Sartain of HAL for Radio-Expo. Well, the weather was cold and damp, but that didn't stop anyone from coming to check out the fleamarket. While it wasn't Dayton weather (at its worst), there was just enough chill in the air to keep everyone moving briskly. The crowd and the fleamarket seemed bigger than last year. Dick found a good deal on a Simpson 260, and I picked up a few more *Radio Boy* books for my collection.

On Sunday afternoon Bill dropped us off at O'Hare Airport on his way home, and Dick and I flew (via Des Moines) to Lincoln, Nebraska, where we met Roger Cox and Dan Dantzler of Telex Hy-Gain the next morning for breakfast. After we ate, we drove out to the Hy-Gain facilities on the other side of Lincoln (yes, Lincoln is that big) and watched as antennas and rotators were being built. One of the impressive sights is their antenna range and test site. We saw their new TH5-DX MKII being put through its paces and even took home a few of the test plots as souvenirs. There's quite a bit that goes into designing, building, and testing antennas.

The following Friday Jack and I flew to Houston for the ARRL West Gulf Division Convention, while Dick and his wife, Cathy, drove up to Boxborough, Massachusetts, for the hamfest there. Lew McCoy and his wife, Martha, met them in Boxborough, and the four manned (or peopled) the *CQ* booth for a very busy weekend. From all accounts it seemed to be about a third larger than the last one and very busy indeed. For Wayne watchers, he was there, too.

When Jack and I landed in Houston we decided to drop in on Madison Electronics on the way to the convention hotel. There certainly is a lot to see. It's very reminiscent of Cortlandt Street in its heyday with bins and boxes of parts and all sorts of good stuff abounding. I found the rest of the aluminum I needed in a barrel in a corner of the store. The weather was perfect for a hamfest, and again bigger crowds turned out for this year's event. The fleamarket expanded beyond the big outdoor tent and into the hotel parking lot. One devoted reader of these editorials followed me around the fleamarket to see what I would buy and was a little disappointed when I came away empty handed. There's always a first time.

The next Friday Dick and I were off to Virginia Beach for the Virginia State Convention. Our Western Advertising Manager, Rich Rutledge, W0YZ, was holding down the fort that weekend at the Santa Cruz, California, hamfest. The Virginia Beach event is held at the new Pavilion Convention Center, one of the best facilities for shows I've ever been to. The fleamarket at this one is always good, and I did manage to stuff my suitcase with a few goodies to bring home. Dick got the bug, too, and carried a few extra boxes back. A lot of the people there checked with me about my antenna and made very favorable comments on the continuing *CQ* saga. There are about eight local clubs in the area, and it seemed they got out and beat the drum for attendance. Good local publicity does pay off.

This coming weekend I'll be going down to Washington for DXPO 82, and next weekend Dick and I will be at the Chattanooga Hamfest. The last weekend of this month (this is being written in October) the whole gang will be out at Great Gorge, New Jersey, for the Hudson Division Convention. That should wrap up our traveling season for this year.

One additional observation should be made at year's end, and that is that most, if not all, of the shows we attended this year featured events and had exhibitors which were of specific interest to computer buffs. More effort is also being placed on attracting people who are into s.w.l.'ing and other enthusiasts of the radio spectrum. This, in turn, is definitely attracting people who are just curious and interested in what's going on, and in this way they are being exposed to amateur radio along with other interesting pastimes. A lot of amateurs are also devoted computer buffs looking to tie both interests together where possible. Perhaps we as amateurs have finally learned after the great CB debacle of the 60s and 70s "how to win friends and influence people." The tangible proof is that through all of these hamfests and conventions more and more people are being exposed to amateur radio and, most importantly, to amateur radio operators. We can all learn from each other.

73, Alan, K2EEK



Say You Saw It In CQ

# The real beauty of the Collins KWM-380 is behind the panel, not on it.

At Collins, we know serious amateurs won't settle for less than professional performance. So we build every KWM-380 to commercial rather than amateur standards. For example, our PC boards are connected by ribbon cables with gold-plated pinfield connectors. The boards themselves are all glass epoxy, and virtually

unaffected by temperature and humidity which cause intermittents in the more commonly used phenolic boards.

Once built, every KWM-380 undergoes 24-hour burn-in, then is aligned and tested to meet or exceed every spec on the data sheet. Which makes us very confident about warranting your KWM-380 for one full year.

The result is a radio with superior performance and lasting quality, not front-panel glitter.

Frequency stability is just one example of its beauty: typically, drift is as low as 10-12 Hz per hour for normal ham shack environments. Other companies haven't matched our performance because they don't match our quality behind the panel.

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# Our Readers Say

## Applauds Bencher

Editor, *CQ:*

I have been reading your magazine for about two years now, and I would like to say *Well Done.* I enjoy your magazine from cover to cover every month.

I would also like to compliment one of your advertisers: Bencher of Chicago, Illinois. I had a very minor problem with the paddle I had, and when I called the factory, they took care of me in a very short time. A company like that deserves a *pat on the back.* It is nice to know *some* companies take care of the hams who buy their products.

Thanks, Bencher. I very much enjoy doing business with you! And thanks to you, *CQ*, for a great magazine.

Mike Dunbar, KC0VY
Hannibal, MO 63401

## From the Philippines

Editor, *CQ:*

Allow me to congratulate you for the July issue of *CQ* magazine. Your magazine in its entirety offers a continuing education for ham operators. The products advertised always are mentioned in QSO's. Keep up with the good work, most especially the Editorial.

The China QSL cards demonstrated your promotion of universal friendship through ham radio. In the Philippines, operators have accentuated the American concept of ham radio's objectives.

I am myself learning more and more from *CQ* magazine. Occasionally, I operate on a small island as can be seen from the enclosed QSL card *(from Florencia Island, Southern Leyte—ed.).* I do hope you can run a story of amateur radio in the Philippines today.

Jake Chung, Jr., DU1JY
Metro Manila, Philippines

## Build A Computer From Sewing Machine Parts?

Editor, *CQ:*

I would like to thank you for the subscription that I won at the Wichita, Kansas Hamfest. It's nice folks like you who care that make the 240 miles I drove seem worthwhile. I think they had a good bunch of exhibits and a large crowd. It's nice to meet and *see* friends who you talk to 300 miles away. I felt it was worth the long trip.

I was tempted to buy a stack of old *CQ*'s for $5.00 at the fleamarket, but I'm mostly into solid state now. I save all my old magazines after I tear out all the pages (with no "meat" on them). I dropped my subscriptions to *Poptronics* and *73* because I felt there wasn't anything left to keep after I tore out all the ads of software junk. When I have leisure time, I like to go through my old magazines and plan a project or two.

I like QRP rigs and am interested in learning about computer hardware, and I would like to build something useful. Remember "Build a ham rig from surplus or junk box TV components"? Why not build a computer from a surplus calculator or surplus auto carburetor computer or sewing machine computer? I know there are junk computers around already that can still do other things.

Thanks, again. I'm anxiously awaiting my first copy of *CQ.*

A.L. Owen, K0CKJ
Liberal, KS

## Siple Station On The Air

Editor, *CQ:*

Since January when I started studying for my Novice license, I have read *CQ.* It is the most readable magazine that I have read and has more information that I as a beginner can use. I regret that over this next year I won't be able to get any copies of the magazine because I am going to the Antarctic for a period of about 15 months. Siple Station, where I will be, is well equipped for amateur radio, and several of us expect to be operating the bands on a fairly regular basis once the rush of the austral summer is over. Because this is our only real means of talking with the outside world, and since we don't get any mail for about 10 months, we look forward to making contact with operators stateside. We also plan to operate on the Novice bands part of every week, so tell the Novices out there to look for us.

Our call at Siple Station is KC4AAD, and my personal call while on the ice will be KA3JXR/KC4. I want to note that I will be more than happy to ragchew most of the time; however, I hope to be on the air for some of the contests, and at that time I will try to work as many operators as I can to give everybody a chance. I will not be competing myself. If it is contest time, please give everybody a chance, OK? I must also urge patience to anyone wanting a QSL because there is no mail service to Siple Station for 10 months out of the year. I will get QSL's out as soon as I can once I return from the ice.

I am looking forward to catching up on all my back reading once I return, so please maintain your high quality. Thanks for this QSO.

Brian Combs, KA3JXR
Camp Hill, PA


CIRCLE 71 ON READER SERVICE CARD

# DRAKE

# TR5 Transceiver

1942-1982
Celebrating our 40th
Anniversary in business
**SPECIAL ANNIVERSARY PRICE**
**$799.95** Amateur Net

# A NEW DIMENSION IN PERFORMANCE

**• U.S. Made • Competitive Price • All Solid State • 12V DC • SWR Protected •**
**• Broadband • No Tune Up • Full Break-in CW • 150 Watts PEP, SSB or CW Input •**
**• High Dynamic Range • Excellent Sensitivity/Selectivity • Digital Readout •**
**• 160-10 Meters Plus WARC Bands and MARS Coverage*•**

Front panel switching allows independent MODE and optional crystal filter selection.

A passive double balanced mixer is employed in the receiver front end. This stage is preceeded by a low noise high dynamic range bipolar rf amplifier to provide good, strong signal performance and weak signal sensitivity.

Accurate digital readout of operating carrier frequency is displayed to 100 Hz.

A rugged, solid-state PA provides continuous duty in SSB and CW modes. A cooling fan (FA7) is available for more demanding duty cycles, such as SSTV or RTTY. The PA also features very low harmonic and spurious output.

VOX GAIN, VOX DELAY, VOX disable, QSK, selectable AGC time constants, RIT and noise blanker selection are front panel controlled for ease of operation.

The TR5 is designed with modular construction techniques for easy accessibility and service.

## GENERAL

**Frequency Coverage:** 1.8-2.0*, 3.5-4.0, 7.0-7.5, 10.0-10.5, 14.0-14.5, 18.0-18.5*, 21.0-21.5, 24.5-25.0*, 28.0-28.5*, 28.5-29.0, 29.0-29.7* MHz. (*With accessory range crystal).

**Modes of Operation:** Usb, Lsb, Cw.

**Frequency Stability:** Less than 1 kHz drift first hour. Less than 150 Hz per hour drift after first hour. Less than 100 Hz change for a ± 10% line voltage change.

**Readout Accuracy:** ± 10 ppm ± 100 Hz.

**Power Requirements:** 13.6 V-dc regulated, 2 A. 12 to 16 V-dc unregulated, 0.8 V rms maximum ripple, 15 A.

**Dimensions:**
*Depth:* 12.5 in (31.75 cm), excluding knobs and connectors.
*Width:* 13.6 in. (34.6 cm).
*Height:* 4.6 in. (11.7 cm) excluding feet.

**Weight:** 14 lb. (6.35 kg)

## TRANSMITTER

**Power Input** (Nominal): 150 Watts, PEP or Cw.

**Load Impedance:** 50 ohms.

**Spurious and Harmonic Output:** Greater than 40 dB down.

**Intermodulation Distortion:** Greater than 30 dB below PEP.

**Carrier Suppression:** Greater than 50 dB.

**Undesired Sideband Suppression:** Greater than 60 dB at 1 kHz.

**Duty Cycle:**
*Ssb, Cw:* 100%.
*Lock Key (w/o FA7 Fan):* 30%, 5 minutes maximum transmit.
*Lock Key (w/FA7 Fan):* 100%.

**Microphone Input:** High Impedance.

**Cw Keying:** Instantaneous full break-in, adjustable delay.

## RECEIVER

**Sensitivity:** Less than 0.5 uV for 10 dB S + N/N except less than 1.0 uV, 1.8-2.0 MHz.

**Selectivity:** 2.3 kHz minimum at – 6 dB. 4.1 kHz maximum at – 60 dB (1.8:1 shape factor).

**Ultimate Selectivity:** Greater than – 95 dB.

**Agc:** Less than 5 dB output variation for 100 dB input signal change, referenced to agc threshold.

**Intermodulation:** (20 kHz or greater spacing) *Intercept Point:* Greater than 0 dBm. *Two-Tone Dynamic Range:* Greater than 85 dB.

**I-f Frequency:** 5.645 MHz.

**I-f Rejection:** 50 dB, minimum.

**Image Rejection:** 60 dB, minimum below 14 MHz. 50 dB, minimum above 14 MHz.

**Audio Output:** 2 watts, minimum @ less than 10% THD (4 ohm load).

**Spurious Response:** Greater than 60 dB down.

## ACCESSORIES AVAILABLE

Model 7021 SL300 CW Filter
Model 7022 SL500 CW Filter
Model 7027 SL1000 RTTY Filter
Model 7023 SL1800 RTTY Filter
Model 7026 SL4000 AM Filter
Model 7024 SL6000 AM Filter
Model 1570 PS75 AC Power Supply
Model 1545 RV75 Synthesized Remote VFO
Model 1531 MS7 Speaker
Model 1507 CW75 Keyer
Model 1558 NB5 Noise Blanker
Model 7077 Microphone

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ANTENNA ROTATORS

for your peace of mind.

Determine the total wind-load area of your antenna(s), plus any antenna additions or upgrading you expect to do. Now, select the matching rotator model from the capacity chart below. If in doubt, choose the model with the next higher capacity. You'll not only buy a rotator, you'll buy peace of mind.

| ROTATOR MODEL | ANTENNA WIND-LOAD CAPACITY: MOUNTED INSIDE TOWER | ANTENNA WIND-LOAD CAPACITY: WITH STANDARD LOWER MAST ADAPTER |
|---|---|---|
| AR22XL or AR40 | 3.0 sq. ft. (.28 sq. m) | 1.5 sq. ft. (.14 sq. m) |
| CD45 II | 8.5 sq. ft. (.79 sq. m) | 5.0 sq. ft. (4.6 sq. m) |
| HAM IV | 15.0 sq. ft. (1.4 sq. m) | N/A |
| T²X | 20.0 sq. ft. (1.9 sq. m) | N/A |
| HDR300 | 25.0 sq. ft. (2.3 sq. m) | N/A |

For HF antennas with booms over 26' (8 m) use HDR300 or our industrial R3501.

Full details at better Amateur dealers or write:

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Europe: Le Bonaparte—Office 711, Centre Affaires Paris-Nord, 93153 Le Blanc-Mesnil, France

CIRCLE 56 ON READER SERVICE CARD

# Announcing

● **Handi-Ham Winter Hamfest** - The annual Handi-Ham Winter Hamfest will be held Saturday, December 4, at the Eagles Club in Faribault, Minnesota starting with registration at 9 a.m. There will be a Handi-Ham equipment auction, dinner at noon, program, and prize drawing. Talk-in on 19/79. For more information, contact Don Franz, W0FIT, 1114 Frank Avenue, Albert Lea, MN 56007.

● **Argonne ARC Special Event** - The Argonne Amateur Radio Club plans to operate the club's Memorial Station, W9QVE, to commemorate the 40th anniversary of the first controlled nuclear chain reaction experiment conducted at the Alonzo Stagg field on the University of Chicago campus. Two stations will operate from 1500 GMT December 4 through 2400 GMT December 5. Frequencies: Phone and c.w. 20 kHz up from lower edge of the General portion of bands 80–10 meters; Novice 40 kHz up; 2 meter 145.19/144.59 repeater, 146.52 and 147.42 simplex; RTTY 14.090 and 146.70. Send business-size s.a.s.e. or $1.00 for 8" × 11" unfolded certificate to AARC, P.O. Box 275, Argonne, IL 60439.

● **Hazel Park (Michigan) ARC Swap and Shop** - The 17th annual Hazel Park Amateur Radio Club Swap and Shop will be held Sunday, December 5, at Hazel Park High School, Hazel Park, Michigan. Hazel Park High School is located on Hughes St. at 9½ Mile Rd., 1 mile east of I-75. Tickets are $1.50 in advance or $2.00 at the door. Tables are $1.00 per foot. Doors open at 8 a.m. Plenty of food, parking, and prizes. Talk-in on 146.52. For tickets, table reservations, and information, send s.a.s.e. to Hazel Park Amateur Radio Club, P.O. Box 368, Hazel Park, MI 48030, or telephone 313-398-3189.

● **Bethlehem, West Virginia Expedition** - The Triple States Radio Amateur Club will operate from Bethlehem, West Virginia, December 9 through December 12, from 1400 to 2300 UTC daily. Operating frequencies for WD8DDL/8 will be 7.275, 14.325, 21.425, and 28.550 MHz on s.s.b., and 7.110, 14.075, 21.110, and 28.110 MHz on c.w. A special holiday certificate will be sent to all those contacted who send an s.a.s.e. to TSRAC, 26 Maple Lane, Bethlehem, Wheeling, WV 26003.

● **Christmas Village Anniversary Celebration** - The K1BCI C/Q Radio Club will operate a Special Event Station honoring the 35th anniversary of the Christmas Village located in Torrington, Connecticut. The club will operate from Christmas Village from December 11 through the 19 on the 10, 15, 20, 40, and 80 meter bands. Certificates of this event will be issued for contacts made. For further information, contact Jim, WA1YZA, or Nellie, WB1DVC.

● **K4HML from Christmas, Florida** - This is the third annual Special Event held by the Colorado Wireless Association. K2HML will be on the air from 1400 to 2200Z on December 18–19 on about 7.282, 14.282, and 21.382 MHz. To receive a special QSL, send an s.a.s.e. to K2HML, P.O. Box 1, Edgewater, FL 32032.

● **KA1CNG from Farmington, Maine** - The Sandy River ARC will operate KA1CNG Saturday, December 18th, 1500Z to Sunday, December 19, 2100Z in celebration of Chester Greenwood Day. They will also operate mobile from the Chester Greenwood Day Parade and related activities on Tuesday, December 21, 1400Z to 2100Z. Frequencies: 5 to 10 kHz from bottom of general band edges and 3940 kHz. Certificate for your QSL card and two first class stamps (no envelopes please) to KA1CNG, 5 Franklin Ave., Farmington, ME 04938.

● **Special Event Station from Santa Claus, Indiana** - The Pike County Amateur Radio Club of Winslow, Indiana, will operate a Special Events Station from Santa Claus, Indiana, from 1700Z December 18 through 1700Z December 19. The call sign will be W9CZH. Operating frequencies will be (plus or minus QRM) 21.395, 14.305, 7.265, 3.925 phone; 7.133 c.w.; 14.093 RTTY; and 146.52 f.m. Certificate for QSL and s.a.s.e. to Santa Claus, P.O. Box 111, Ireland, IN 47545.

● **Attention to Military Communicators** - If you have ever served, or are currently serving, with the U.S. Army Signal Corps, either in the military (active, reserve, or National Guard) or as a civilian employee, you are invited to join the U.S. Army Signal Corps Association. Communicators from sister services and allies are also welcome to join. Members of the Association represent many skills and skill levels and share a background of highly specialized training and working together as an integrated team. Members of the Association receive copies of the *Army Communicator*, the voice of the Signal Corps, as a benefit of membership. This journal contains timely articles on worldwide communication developments. Additional information and applications for membership are available by contacting: Signal Corps Association, P.O. Box 7740, Fort Gordon, GA 30905.

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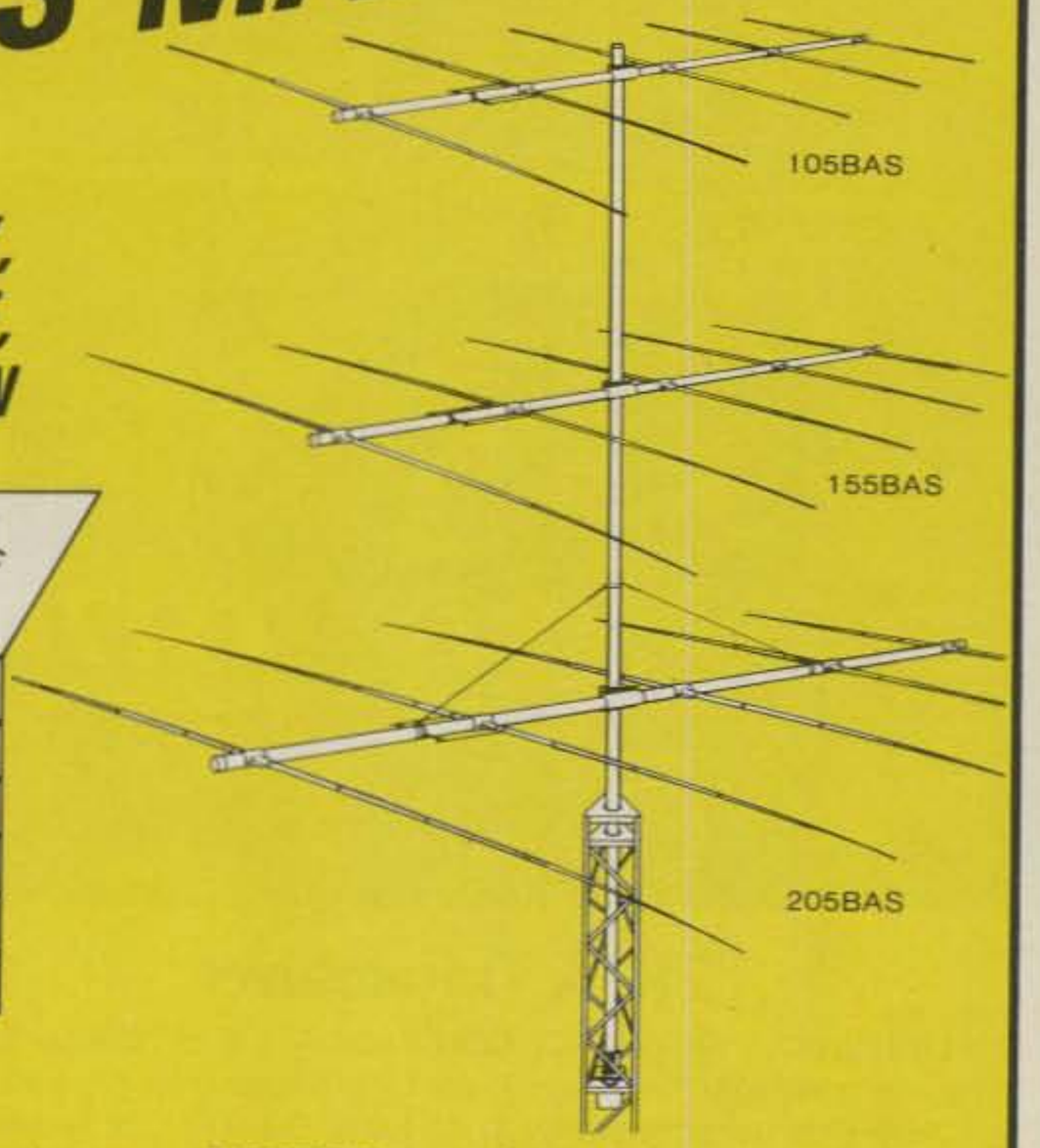
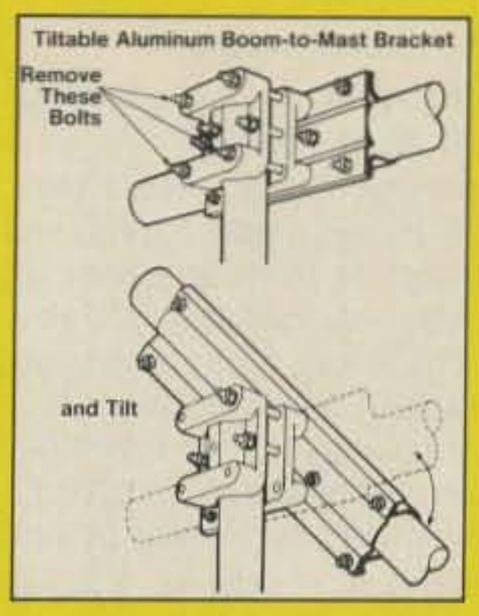
# MONOBANDERS MAXIMUS

## MAX. MECHANICAL INTEGRITY, ELECTRICAL PERFORMANCE, SPACE SAVINGS AND SELECTION




| MODEL NO. | AVERAGE GAIN | MAXIMUM F/B RATIO | NO. OF ELEMENTS | LONGEST ELEMENT | BOOM LENGTH | TURNING RADIUS | BANDS | SHIPPING WEIGHT |
|---|---|---|---|---|---|---|---|---|
| | db | db | | ft. / m | ft. / m | ft. / m | Meters | lbs. / kg |
| 402BAS | 4.9 | 25 | 2 | 45.9 / 14 | 16.1 / 4.9 | 25 / 7.6 | 40 | 47 / 21.3 |
| 204BAS | 10 | 25 | 4 | 36.5 / 11.1 | 26 / 7.9 | 22.5 / 6.7 | 20 | 55 / 25 |
| 205BAS | 11.6 | 35 | 5 | 36.5 / 11.1 | 34 / 10.4 | 25 / 7.6 | 20 | 77 / 35 |
| 155BAS | 12 | 25 | 5 | 24.5 / 7.5 | 26 / 7.9 | 17.5 / 5.3 | 15 | 42 / 19 |
| 105BAS | 12 | 35 | 5 | 18.5 / 5.6 | 24 / 7.3 | 15 / 4.6 | 10 | 29 / 13 |

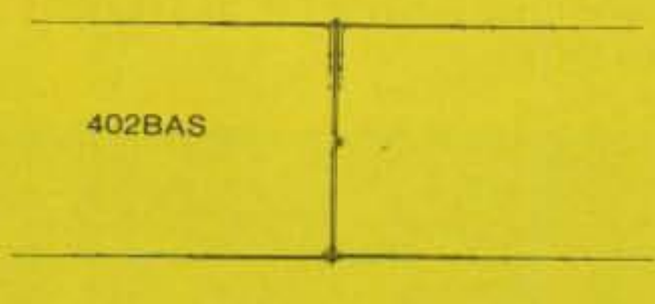
3-Element Monobanders also available.
Optional BN-86 balun recommended for above antennas.

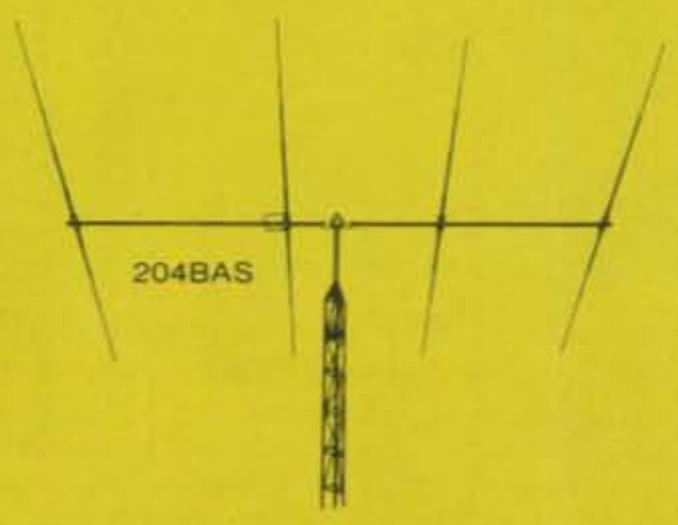



MECHANICALLY Hy-Gain monoband antennas employ the best materials available and are fabricated with accurate tooling for an integral balance so all parts work together. For example, our element-to-mast brackets are the best in the industry and our tiltable mast-to-boom clamps are unique. Stainless steel hardware is chemically passivated to eliminate rust. All tubing and parts are deburred and finished so you don't have to re-manufacture the antenna before installation. It all adds up to antennas with maximum mechanical integrity that withstand 80 mph (129 km/h) windloads and radial ice.

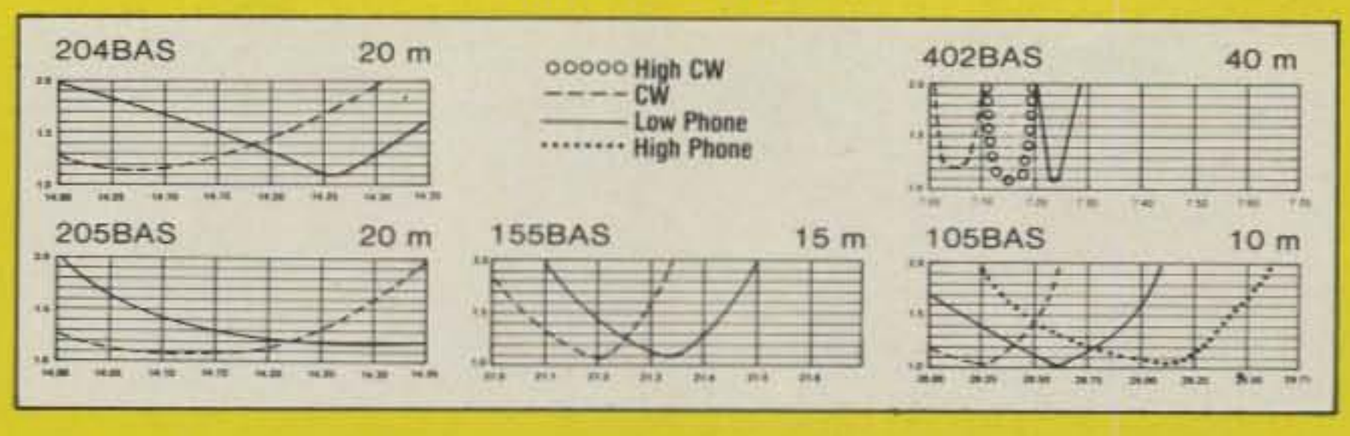
ELECTRICAL performance is not based on theoretical calculations alone but is tuned and tested for optimum results on our government approved test range. Hy-Gain's factory tuned 52 ohm Beta Match is exclusive and assures positive dc ground for lightning protection and reduced precipitation static. Though sometimes unconventional, our meticulous element spacing assures maximum F/B ratio and uncompromising power gain. VSWR at resonance is less than 1.5:1. All Hy-Gain monobanders handle maximum legal power with a 4:1 safety margin. In short, electrical performance is at maximum by design and requires no re-tuning.

SPACE problems are virtually eliminated. Even our largest monoband antennas fit most residential lots. And thanks to Hy-Gain's careful materials selection and superb mechanical engineering, the weight and windload of antennas is at an absolute minimum to permit stacking on conventional heavy duty towers and rotators. This gives you maximum DX performance even with limited space.




**MONOBAND BEAMS**

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# The ultimate team... the new Drake "Twins"

## The TR7A and R7A offer performance and versatility for those who demand the ultimate!

### TR7A Transceiver

• **CONTINUOUS FREQUENCY COVERAGE** — 1.5 to 30 MHz full receive coverage. The optional AUX7 provides 0 to 1.5 MHz receive plus transmit coverage of 1.8 to 30 MHz, for future Amateur bands, MARS, Embassy, Government or Commercial frequencies (proper authorization required).

• **Full Passband Tuning (PBT)** enhances use of high rejection 8-pole crystal filters.

New! **Both 2.3 kHz ssb and 500 Hz cw crystal filters, and 9 kHz a-m selectivity are standard,** plus provisions for two additional filters. These 8-pole crystal filters in conjunction with careful mechanical/electrical design result in realizable ultimate rejection in excess of 100 dB.

New! **The very effective NB7 Noise Blanker is now standard.**

New! **Built in lightning protection** avoids damage to solid-state components from lightning induced transients.

New! **Mic audio available** on rear panel to facilitate phone patch connection.

• **State-of-the-art design** combining solid-state PA, up-conversion, high-level double balanced 1st mixer and frequency synthesis provided a no tune-up, broadband, high dynamic range transceiver.

### R7A Receiver

• **CONTINUOUS NO COMPROMISE 0 to 30 MHz frequency coverage.**

• **Full passband tuning (PBT).**

New! **NB7A Noise Blanker supplied as standard.**

• **State-of-the-Art features** of the TR7A, plus added flexibility with a low noise 10 dB rf amplifier.

New! **Standard ultimate selectivity choices** include the supplied 2.3 kHz ssb and 500 Hz cw crystal filters, and 9 kHz a-m selectivity. Capability for three accessory crystal filters plus the two supplied, including 300 Hz, 1.8 kHz, 4 kHz, and 6 kHz. The 4 kHz filter, when used with the R7A's Synchro-Phase a-m detector, provides a-m reception with greater frequency response within a narrower bandwidth than conventional a-m detection, and sideband selection to minimize interference potential.

• **Front panel pushbutton control** of rf preamp, a-m/ssb detector, speaker ON/OFF switch, i-f notch filter, reference-derived calibrator signal, three agc release times (plus AGC OFF), integral 150 MHz frequency counter/digital readout for external use, and Receiver Incremental Tuning (RIT).

## The "Twins" System

• **FREQUENCY FLEXIBILITY.** The TR7A/R7A combination offers the operator, particularly the DX'er or Contester, frequency control agility not available in any other system. The "Twins" offer the only system capable of no-compromise DSR (Dual Simultaneous Receive). Most transceivers allow some external receiver control, but the "Twins" provide instant transfer of transmit frequency control to the R7A VFO. The operator can listen to either or both receiver's audio, and instantly determine his transmitting frequency by appropriate use of the TR7A's RCT control (Receiver Controlled Transmit). DSR is implemented by mixing the two audio signals in the R7A

• **ALTERNATE ANTENNA CAPABILITY.** The R7A's Antenna Power Splitter enhances the DSR feature by allowing the use of an additional antenna (ALTERNATE) besides the MAIN antenna connected to the TR7A (the transmitting antenna). All possible splits between the two antennas and the two system receivers are possible.

Specifications, availability and prices subject to change without notice or obligation.

DRAKE

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**Compatible with TR5 and 7-Line Xcvrs/Rcvrs**

• **Frequency Synthesized** for crystal-controlled stability • **VRTO (Variable Rate Tuning Oscillator*)** adjusts tuning rate as function of tuning speed. • **Resolution to 10 Hz** • **Three programmable fixed frequencies** for MARS, etc. • **Split or Transceive operation** with main transceiver PTO or RV75

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* Patent pending

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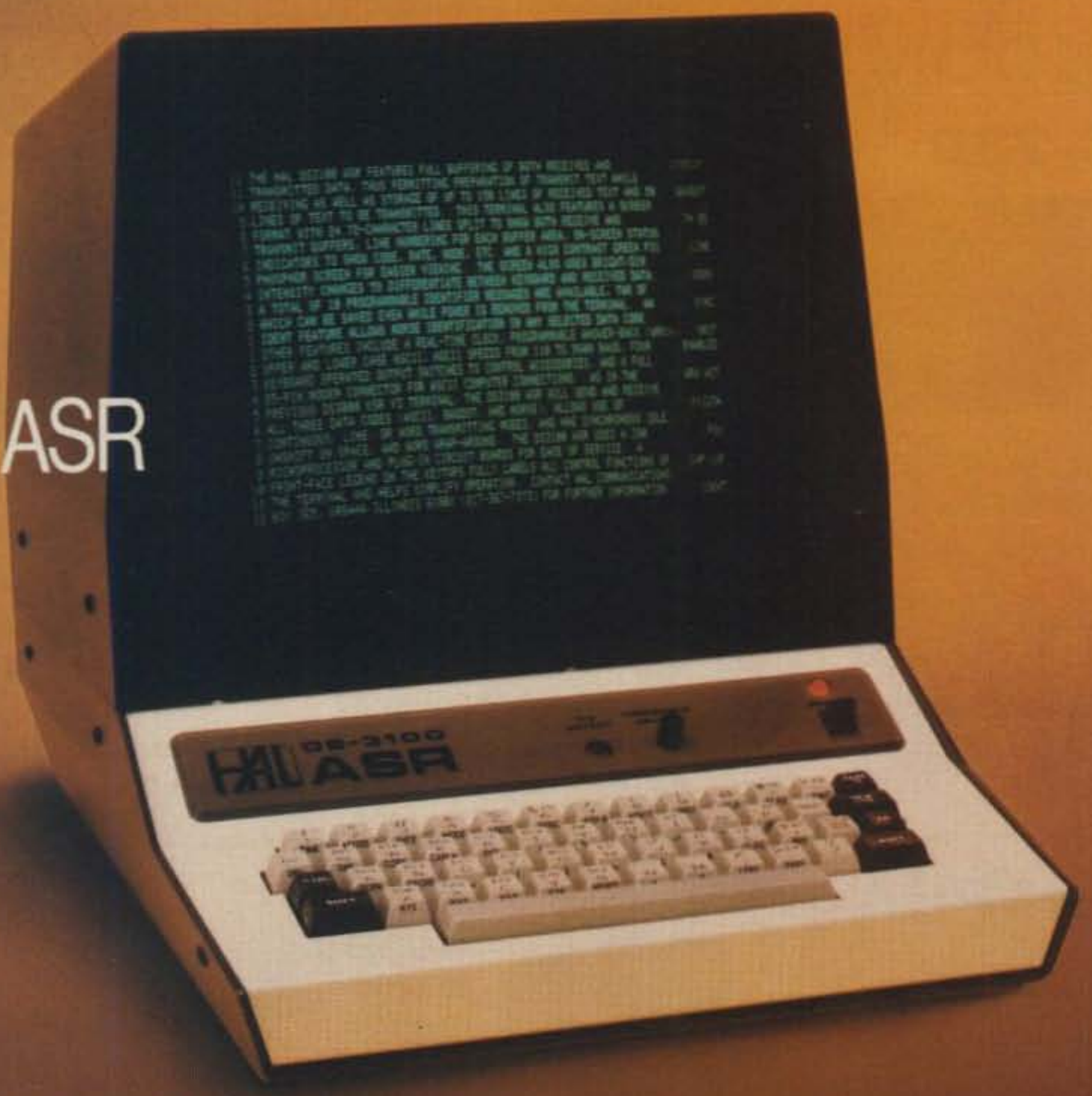


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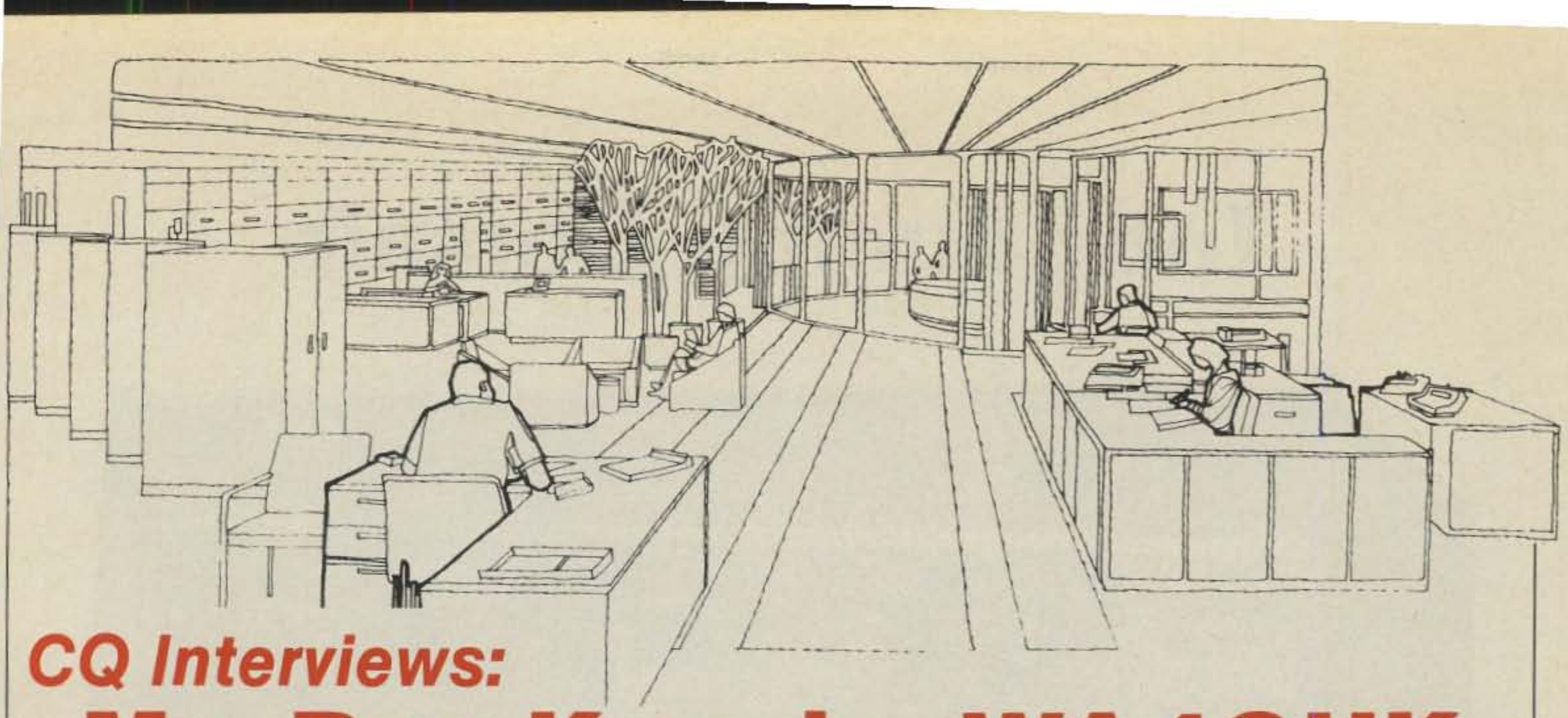

# CQ Interviews:

# Mr. Ray Kassis, WA4OHK

## President, Cablesat General Corporation

BY BILL PASTERNAK*, WA6ITF

*As 1982 draws to a close, we'll generally reflect on what kind of year it has been. The Christmas season brings out the stories of hope and joy and the promise of a better new year. We never seem to tire of the "Yes Virginia, there is a Santa Claus" parable. Good things do happen, and it is important to dream of impossible things, things to work for, things to strive for, and things that ensure a bright future for all.*

*Well, there's a new and different kind of dream shaping up for 1983 and amateur radio. Although he's not Santa Claus, Ray Kassis, WA4OHK, is trying to bestow a gift on amateur radio that would have been the impossible dream a few years back. We thought we would end the year in a very up mood by presenting an interview with Ray done by Bill Pasternak, WA6ITF. Bill is the producer of the Westlink Radio Network and the editor of* Westlink Report. *—K2EEK*

First word of the gift came on August 23, 1982 when the ARRL issued the following bulletin: "Last week, Cablesat General Corporation (CGC) filed an application with the FCC for permission to operate two geostationary satellites. Included on each satellite will be an amateur radio network experimental transponder, ARNET. The anticipated uplink frequency is 5.65 to 5.67 GHz and downlink is 3.40 to 3.41 GHz. It is estimated that amateur radio terminals using antennas of 2 meters (approximately 6 feet) in diameter, with r.f. power amplifiers of 10 watts or less, will provide ample voice communications performance via the transponders. Launch is scheduled for late 1985. FCC approval is pending. The transponders are being donated by CGC for ARNET use, and CGC President WA4OHK has asked the ARRL to coordinate all activities and establish standard operating procedures. This opportunity will allow the amateur community to expand into new areas of experimentation, education, public service, and emergency communication. . . ."

It was not until the 31st that I was able to reach WA4OHK by telephone. In the interim, I developed as much background material as I could on both CGC and the offer of the transponders.

It is no secret that the cost of transponders on communications satellites is rather steep. Last year, for instance, RCA held an auction on transponders to be made available on an upcoming *Satcom* launch. The average price paid for a 10-year lease on one of those transponders was a whopping 10 million dollars. Some of the leases went for considerably more. Why, then, would anyone be willing to give away the potential of 20 million dollars in corporate profit? Moreover, the basic hardware cost and the monies necessary to place the finished bird into geostationary orbit are necessarily prohibitive. Again, why would any individual or business concern spend this vast sum on a hobby service? There were other questions as well, and I knew that there would be only one person who could provide the answers: Ray Kassis, WA4OHK. What follows is the basic text of my phone interview with CGC President Kassis.

**CQ:** Ray, when someone gives away a 20 million dollar pair of satellite transponders, that's news.
**Kassis:** Well, pending FCC approval.

**CQ:** A lot of hams who knew I was calling you asked that I say thanks.
**Kassis:** That's good. Now if we can just get the amateur community behind the proposal, and if we can get the Federal Communications Commission to act favorably on the venture of Cablesat General Corporation and ARNET, we will have a service that is second to none.

**CQ:** Let's go back to the beginning. Where did the idea to include amateur transponders on these geosynchronous satellites come from?
**Kassis:** I'm an amateur radio operator myself. My call, as you know, is WA4OHK, and being caught up in the satellite business, I saw the opportunity for extending the service to the amateur community as something that's just natural. It was never a problem or something that we did not want to do. Rather, we finally found a spacecraft manufacturer that had some very enthusiastic amateurs in the design and engineering departments who could come up with a way of adding an amateur radio transponder and its associated antennas to the spacecraft without going through a major redevelopment or change in the spacecraft technology.

**CQ:** What company is developing the spacecraft?
**Kassis:** The spacecrafts are being developed by RCA Astro-Electronics Corporation. This is the same company that builds all of the RCA spacecraft (*Satcom, etc.—ed.*), and they have a tremendous track

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record under their belt for NASA. They build all of the Canadian satellites, and they were just awarded the Direct Broadcast Satellite contract from the very first applicant for D.B.S.

**CQ:** Will these be D.B.S. satellites?
**Kassis:** No, they are not. We do have on file with the FCC an application for a D.B.S. satellite system. We were one of the first of the 14 companies which applied. However, that spacecraft is too large to accommodate an amateur radio transponder, and we had to let that idea rest for our D.B.S. application (*the satellites*). We are proposing to go up with our "C-Band" satellites, operating in the domestic communications satellite allocation.

**CQ:** Does this mean an S.T.A. will be necessary?
**Kassis:** I figured that we had best go with a "C-Band" type transponder, or get as close to "C-Band" as we could, and we discovered that the FCC had allocated a group of frequencies adjacent to the domestic "C-Band" operation that would make it very easy to add an amateur radio transponder, plus I was concerned with amateurs having the necessary equipment to receive the signal from the spacecraft. As you know, "C-Band" is the most popular type of transmission system used by cable TV, data transmission, and even home terminals (TVRO's). Even R.L. Drake, as well as many others, has come out with receivers well within the reach of the average amateur operator. I felt it was a natural when the FCC approves closer spacing on the domestic "C-Band" satellites. The equipment now in use by the commercial satellite industry will become obsolete because of its inability to separate signals coming down from domestic "C-Band" operations, and amateurs will have a flood of 4 meter, 5 meter, 3.7 meter dishes all of a sudden appearing on the surplus market. That's when amateurs can come in and really scoop up these dishes and provide substantial two-way communication via satellite.

**CQ:** What would you value these two transponders at if you had to place a monetary value on them?
**Kassis:** Actually, I never did put a value on them. It was just to find out from the spacecraft manufacturer if they could be incorporated into our domestic satellite proposal. You're right; it does run a number of millions of dollars. Especially when you amortize the service that they will provide over their 10-year life expectancy. I've never put a dollar value on it, but whatever the value is, I think that what we in the amateur community will reap and the public service that will be rendered through geostationary spacecraft like this will far exceed whatever the costs might be.

**CQ:** This leads to an obvious question. Why are you doing this?
**Kassis:** I'm a broadcaster and I'm also an amateur radio operator. I think that the scientists and engineers at the spacecraft manufacturing plant of RCA Astro-Electronics, as well as amateurs who are involved in this space age technology, are all enthusiastic about including in (*the satellites*) an amateur radio service which really should have been up and running years ago. I think the time has come for this to take place, and I am honored and thrilled to have a small part in making it work.

**CQ:** What kind of amateur communications do you foresee using the satellites?
**Kassis:** In our proposal, we have left most of the parameters open to the ARRL to come up with a set of standards for use of the 10 MHz wide transponders, and that's a tremendous bandwidth. I would like to see us develop . . . naturally . . . emergency communications and interlinks with . . . say, a number of 2 meter repeaters and 450 repeaters. I would like to see, and I know that the League has been talking about possibly having, a portion of the transponders used for television transmission. I think that Packet Radio now becomes a practical application for the amateur radio service with geostationary satellites that can be accessed and then redistributed throughout the



Say You Saw It In CQ

United States almost instantly. I think we ought to look into spread spectrum as another type of technology, as another technique we need to develop. Naturally, in the amateur community spread spectrum through amateur radio satellite communication could really pave the way for the future of communications in general. I see a lot of applications, and I'm just excited to see this thing take off.

**CQ:** What, then, can the average amateur do to help this project get off the ground?
**Kassis:** I think that the greatest help that the amateur radio operator can do, both individually and collectively, is to let the FCC know that this approach, this technology, the idea of having transponders on geostationary spacecraft and available to the amateur community, will further enhance the experimentation, the development, and practical application in the fields of emergency (*communication*) and public service. Just endorse it and be vocal about this project. It could be the most significant development for the amateur radio community that has come along in many years in the United States. I think that just to be enthusiastic and endorse it and to write to those who need to be written to and take a stand is the greatest help.

**CQ:** Only one of the 24 transponders on each bird will serve amateur radio. The other 23 are for commercial programming mainly to cable TV companies. If a CATV operation wanted to carry whatever amateurs might come up with on transponder 24, could they?
**Kassis:** Well, I imagine that the same rules (barring rebroadcast of the amateur service) would apply to receiving amateur transmissions as are found on any other amateur band, as well as from these satellites to a cable company. I would really have to reserve an answer on that until I explore whether or not that's legal for rebroadcast. I don't really know.

**CQ:** Tell us a bit more about the overall project.
**Kassis:** I have the specs here for the satellites. . . . You can't really illustrate it by voice over the phone, but . . . wow . . . are those transponders going to have coverage!

**CQ:** What's their *footprint*?
**Kassis:** We are going with circular polarization, but the amateur transponder will not have the same characteristics of a typical "C-Band" transmission. We don't have to protect South America on the amateur bands.

**CQ:** I believe that the amateurs down there might welcome the satellites.
**Kassis:** That's right. They will, and the system will have coverage that's just absolutely out of this world . . . Central America, Mexico, . . . parts of South America from the eastern bird. From the western bird you are looking at most of the Pacific as well.

**CQ:** Are you saying "get on your local repeater and talk to Hawaii"?
**Kassis:** That's right. That's absolutely correct.

**CQ:** Have you gotten much feedback from the amateur community since the ARRL released the news last week?
**Kassis:** No, and I don't know whether it's because they (*amateurs*) don't know who we are or what.

**CQ:** Okay, let's tell the amateur community a bit about CGC.
**Kassis:** We grew out of a company called National Christian Network. That's the main operation here. National Christian Network is one of the programmers on the RCA Satcom 4 satellite. We (*CGC*) program it. We have video and a number of audio sub-channels, and National Christian Network was the entity that applied for D.B.S. We were one of the 14 applicants, though we haven't gotten approval yet. We're still fighting, and it's still pending before the FCC.

When we made that proposal, we tried to put the amateur radio transponder on that bird, but it was just not practical. We then in turn formed Cablesat General Corporation. It's a fairly new company, formed and chartered for the purpose of operating a domestic "C-Band" satellite system. Cablesat General will be using the birds primarily to provide cable television programming, but with a different approach than what we now have.

**CQ:** Elaborate on this a bit.
**Kassis:** Cablesat General will be taking a modernistic approach to cable programming. For example, on the current satellites that cover all of CONUS (*CONtinental United States*), up to 40% of the channels that are on those satellites are used for specific feeds to the east or west coast . . . such as HBO East and HBO West. The same with Showtime, Warner, Amex, and others, where the satellite, even though it covers all of the United States, doesn't really provide programming for all of the time zones. We see a very inefficient use of the spectrum which is very crowded and very precious—especially parking spaces along the geostationary arc.

So, we came up with the proposal of Cablesat East and Cablesat West. Cablesat East is to be placed far enough on the eastern extreme of the geostationary arc so that it will only cover with its primary signal the eastern half of the United States. It will be "seen" in the western half, but the angle of elevation drops considerably, and you lose a couple of states in the northwest. The same approach is used with Cablesat West, which is our second bird. It again is on the western end of the geostationary arc and probably will not be seen . . . or watched . . . or


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looked at in Maine or places like that. What you have, then, are two satellites that cover the entire United States with a grade "A" signal, but with programming on those satellites aimed at those particular halves of the country.

**CQ:** Can you carry this a bit further?
**Kassis:** When a cable system installs its "dish" and looks at Cablesat East, for example, all transponders will be available, programmed, and featured for those time zones. That's how you get more efficient use of a cable system ground terminal.

**CQ:** Isn't this similar to what's being done by World Communications (ITNA) and others in relation to news gathering and distribution?
**Kassis:** Exactly, but we feel that by the mid-1980's the ability to videoplex, to provide two program services on each transponder, will become practical from a cost standpoint. It can be done now, but it's too expensive. This is a very practical piece of technology, but it's just not low enough in cost to make it practical for cable distribution. I feel that by 1985 both the transmit and receive (*for videoplex*) will be inexpensive enough so that a 24-channel satellite will be able to provide upwards of 48 services. By doing this we double the effective use of the spacecraft. You can now tie into this the possibility of even additional regionalization.

**CQ:** Can you illustrate?
**Kassis:** Take the east-coast bird. You feature a service like HBO, and you can feature both HBO Eastern and HBO Central. Now the 9 o'clock movie can be featured at 9 p.m. in each time zone.

**CQ:** What else will be done with the satellites?
**Kassis:** Then we are going to develop the use of an exhaustive Emergency Broadcast System which will take into consideration all of the uplinks going to the satellites, all of the downlinks being received, and will have an interconnecting network through the bird. Now if you are watching a pay movie service, say in some small town in Oklahoma, and your cable system is unattended, the chances are that you will never know of tornado warnings in your area. What we hope to establish is a system in which unattended cable systems can automatically be downstream keyed with weather warnings and, of course, with the other uses of emergency broadcasting.

**CQ:** Open caption teletext?
**Kassis:** That's right. You can take it from there into anything. You know, there is just no end to what you can do with the technology if you only apply it. Right now, though, if you were watching a pay TV service and there was a national attack, or if there were flash floods or tornadoes, or whatever happens to be in your area, you probably would never know about it. Down here (*in Florida*) we have hurricanes.

**CQ:** Want to trade hurricanes for our earthquakes?
**Kassis:** No thanks. I'll keep the hurricanes! But these are some of the ideas that we have for the transponders that will be on birds in the domestic service. These are all ideas that should be implemented. The ARNET proposal was just one of them which fit in very naturally, and fortunately we were able to have the engineers say: yes it can be done; we're glad you asked us; what a fantastic opportunity and let's go with it.

**CQ:** Sounds like some of those engineers are amateurs.
**Kassis:** Most of them are. In fact, the chief scientist is not a ham, but is so caught up with the proposal that he probably has put in more hours than even the amateurs have because he likes the concept of what amateur radio stands for. Even from the legal community, the liaison attorneys in Washington D.C. who deal with the FCC on our behalf, none of whom are amateur operators, are all showing considerable interest and excitement about the ARNET proposal.

**CQ:** Any opposition at all?
**Kassis:** None that I have heard of.

**CQ:** Ray, I want to take this opportunity to thank you for taking the time to talk with us about your proposal—especially the applications aspect—in a way that everyone can comprehend. I know a lot of us will be very happy if and when the FCC gives ARNET and the whole project the green light.
**Kassis:** You are very welcome.

After we hung up, I sat for a moment wondering what our hobby service will be like the day we have access to geostationary satellites of the type that Ray Kassis has proposed. One of these days we might just pick up an HT, dial up our favorite repeater, maybe plunk-in a few touchtones, and find ourselves in a great DX QSO without the problems usually inherent in working a DX station on the h.f. bands. Will New York to Hawaii or California to Puerto Rico on 2 meters, 220 MHz, 450 MHz become a daily occurrence for QSO's enroute to work? What about a national Disaster Alert Network? Packet communications? Within 3 years could this all come about? If Ray Kassis, WA4OHK, has his way it will.

I am reminded of something said by another amateur at the very close of a well-known amateur radio film. Those of you who have seen Dave Bell, W6AQ's "The World of Amateur Radio" will remember Roy Neal, K6DUE's closing comments in that motion picture. They were not scripted, not in the true sense. Rather, they were a statement of hope. "There you have it. The world of amateur radio. Most of all it's people communicating with people, and in our future as hams we dream of the day when members of our fraternity will be orbiting earth in space stations, or inhabiting colonies on the moon or Mars. We see in the near future handheld radios like this linked to satellites that will give us world-wide person-to-person capabilities. But, most of all, in the here and now our hobby gives us the world. A world of learning, of helping others, and just plain having fun."

Those words were not just something for the camera. Rather, they were a statement of how those who put the film together envisioned the future. Thanks to the overwhelming generosity of Ray Kassis, WA4OHK—a man who is willing to bypass upward of 20 million dollars in income to his corporation, a man obviously dedicated to the same ideals as others in our vast worldwide hobby service—that dream, that concept that K6DUE brought forth in 1979, might be a part of our amateur radio way of life by 1985. At least a lot of us hope so. CQ

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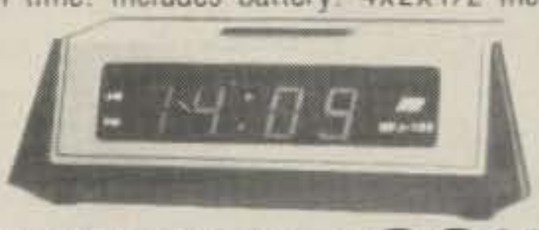

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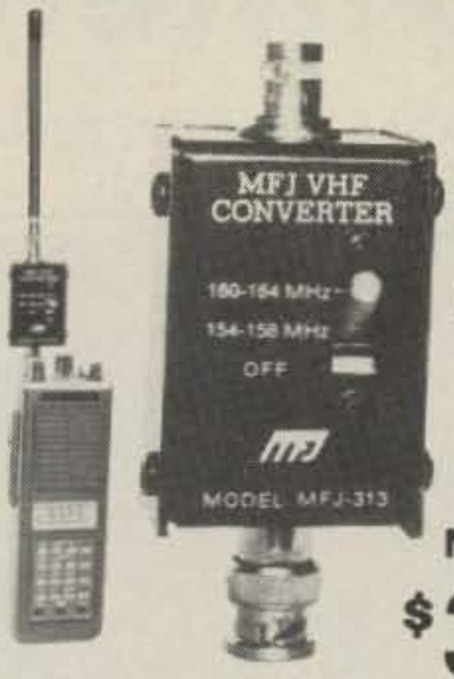


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***The following article represents a description and system analysis of an antenna that is an integrated combination of a short passive element and a gain amplifier.***

# Active Antennas

BY DR. ULRICH L. ROHDE*, DJ2LR

*Dr. Rohde has been a regular contributor to the amateur press. He is the designer of the HF-1030 receiver, which is now being marketed by Cubic Communications. He is a sought-after guest speaker and recently was a featured speaker at the ARRL national convention in Cedar Rapids. The material in this article was originally presented in a paper published by* r.f. design *magazine, May/June 1981.*
*—K2EEK*

The active antenna in its minimum configuration consists of a passive antenna, typically a rod or a dipole, and an integrated amplifying device.

Let us look at the simple case in which a rod antenna is directly connected to the input of a field effect transistor. As shown in fig. 1, the antenna acts as a source that feeds the transistor. The electric field strength E generates a voltage (EMF) that can be determined from $V_a = E \bullet h_e$. The antenna has a capacitance $C_A$ and for small electrical lengths, this is 25 pF/meter, while the transistor has an input capacitance $C_T$. These two capacitances form a capacitive voltage divider. The signal voltage that drives the transistor is then

$$V_T = \frac{E \cdot h_e}{1 + C_T/C_A}$$

For electrically short antennas the voltage $V_T$ is nearly independent of frequency. Therefore, the active antenna has an extremely wide bandwidth.

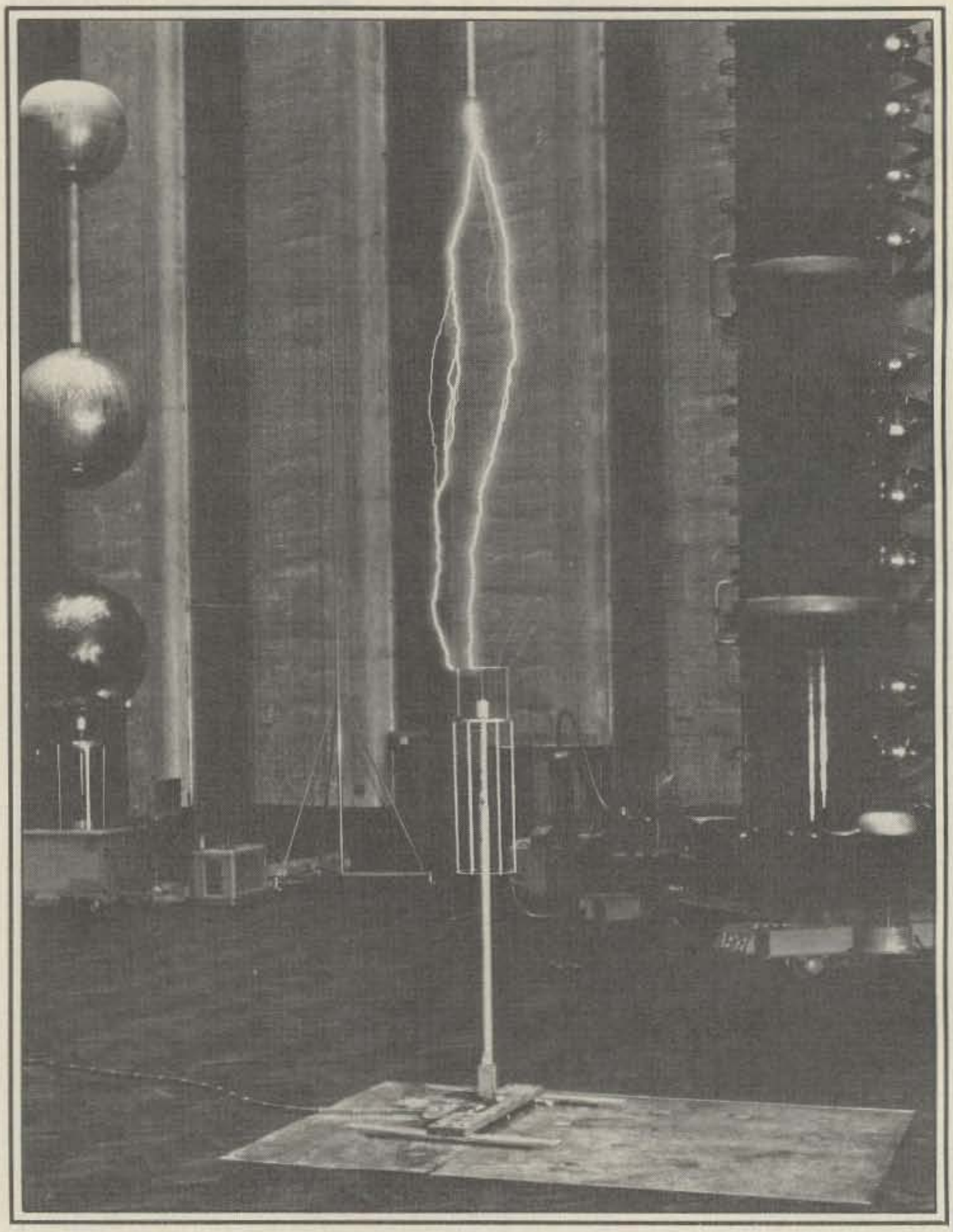
The gain-bandwidth product of such a device can be computed from the performance of the field effect transistor in fig. 1. It will reproduce at the output the input voltage as long as its cut-off frequency is high enough. Additional reactances (for frequency selectivity) may be added to intentionally limit the bandwidth of the active antenna.

Output power is not considered of primary importance since post amplifiers can always be added. Therefore, only the signal-to-noise ratio is worth considering.

Assume that the active antenna has sufficient gain. Then the signal-to-noise ratio is determined by the active antenna and not by the receiver. The only internally generated noise is from the transistor since the passive antenna must be considered noise free.

In analyzing the output of the active antenna, there are three components to consider:

a) The signal voltage at the operating frequency.



*This dramatic shot shows the controlled testing of an active antenna. The antenna is being tested under lightning conditions and direct lightning strikes, as the antenna should be lightning-proof. (See schematic on page 24.)*

*President, Communications Consulting Corp., 52 Hillcrest Drive, Upper Saddle River, NJ 07458



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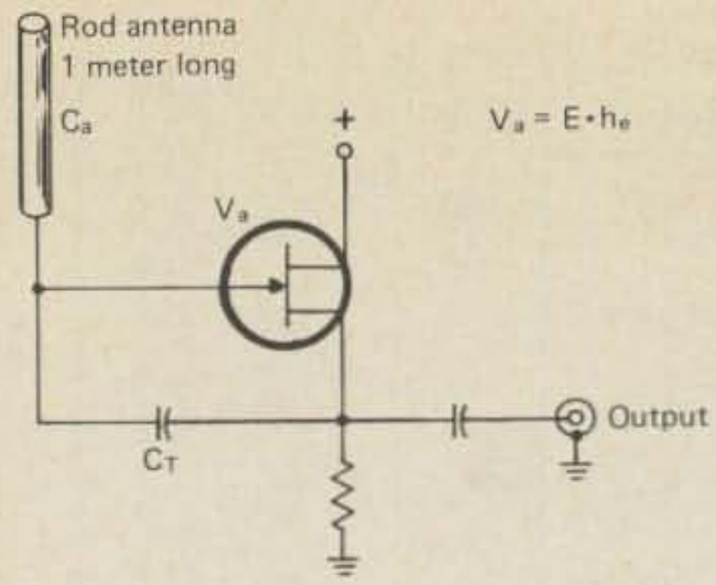


*Fig. 1– The minimum equivalent circuit of an active antenna.*

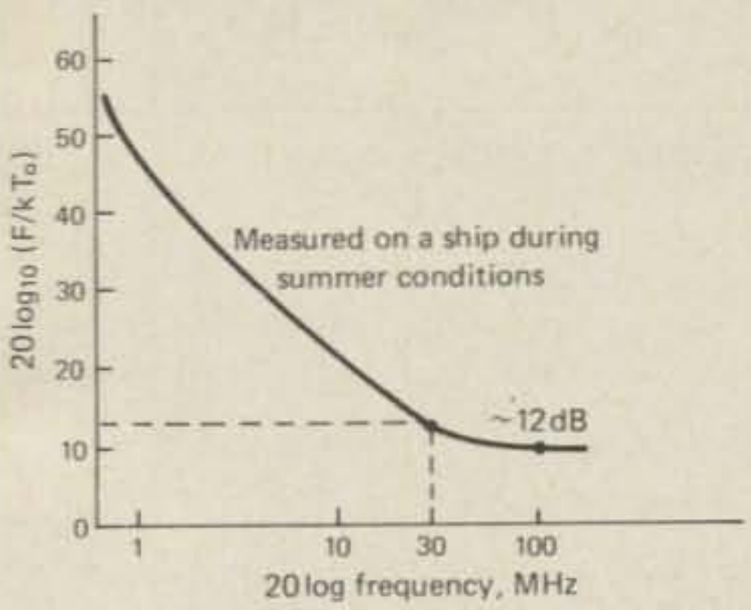


*Fig. 2– Atmospheric noise as a function of frequency.*

b) The amplified noise generated by external sources (man-made or galactic), and

c) The transistor noise contribution.

As long as the noise voltage generated by the transistor at the amplifier output is less than the wideband noise picked up by the antenna, the system is capable of supplying the same signal-to-noise ratio as an optimized passive antenna for the same specific frequency.

Let us assume for a moment that we have an active antenna with a 1 meter long rod element. Its capacitance is 25 pF. A typical value for the FET is 5 pF, or one fifth. Consequently, 80 percent of the antenna output is applied to the FET input.

If a passive full wavelength long dipole were used instead at, say, 10 MHz (30 meters long), the open-circuit voltage (EMF) would be 30 times higher than that generated by the 1 meter long rod. In addition, the atmospheric noise term would be greater. However, the 1 meter rod, for all practical purposes, generates the same, or practically the same, signal-to-noise ratio as a dipole with the difference that individual (signal and noise) levels are smaller. The difference in amplitude can be compensated for by an amplifier under the restriction that atmospheric noise divided by the ratio of (full size antenna/1 meter) is equal to or better than the noise figure of the transistor amplifier.

The average noise power of the ionosphere at these low frequencies is seen in fig. 2. These are the figures measured in typical rural areas. It becomes apparent that if these voltages are divided by 50, the noise floor approaches the noise floor of the best FETS—i.e., approximately 1 to 2 dB.

## Intermodulation Distortion

Intermodulation distortion is another type of noise that is generated in the transistor or active device as a function of the input signals. The active antenna, therefore, is best described by assigning to it:

a) A frequency range

b) A minimum sensitivity which is determined by the noise figure

c) A dynamic range which is determined by the second, third, and higher-order intercept points, and

d) Polarization (horizontal or vertical).

The simplest active antenna configuration using an FET is illustrated in fig. 3. This circuit exhibits high second-order intermodulation distortion due to the antenna square-law characteristic. A push-pull configuration that can be used for tests and evaluations of such a system is illustrated in fig. 4.

### Active Antenna Dynamic Analysis (See Table I for terminology.)

System noise figure is defined by

$$F_S = F_A + \frac{(F_R - 1) \cdot a}{G_v}$$

The electrical gain of the antenna is defined by

$$G_v = 4\left(\frac{V_a}{V_o}\right)^2 \cdot \frac{R_A}{Z_L}$$

For reasons of best dynamics, assume $V_a/V_O = 0.5$.

With these assumptions in mind, the noise figure of the antenna now becomes

$$F_A = F_{min}\left(1 + C\frac{(Z_A - Z_{opt})^2}{R_A \cdot R_{opt}}\right) = F_{min}(1 + A)$$

The impedance $Z_A$ and $Z_{opt}$ are

$$Z_A = R_A + jX_A \qquad 0.25 < C < 0.5$$

$$Z_{opt} = R_{opt} + jX_{opt}$$

If the antenna is set for the greatest possible bandwidth, $X_{opt}$ becomes 0. The antenna noise figure then is

$$F_A = C\left(\frac{R_A}{R_{opt}} + \frac{R_{opt}}{R_A} + \frac{X_A^2}{R_A \cdot R_{opt}} - 2\right)$$

This particular type of matching requires a high input impedance. Therefore:

$$\frac{R_A}{R_{opt}} << \frac{R_{opt}}{R_A} \cdot \frac{R_A}{R_{opt}} + \frac{R_{opt}}{R_A} + \frac{X_A^2}{R_A \cdot R_{opt}} >> 2$$

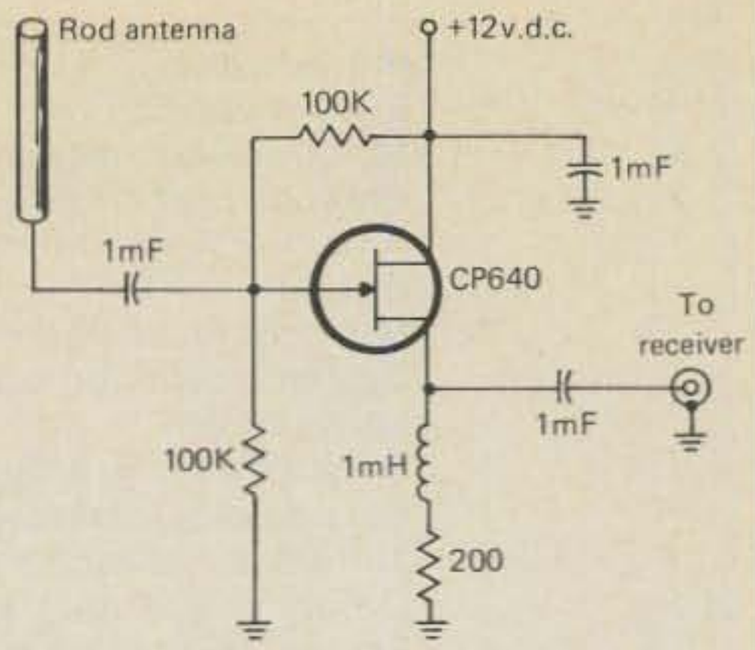


*Fig. 3– A simple active antenna.*

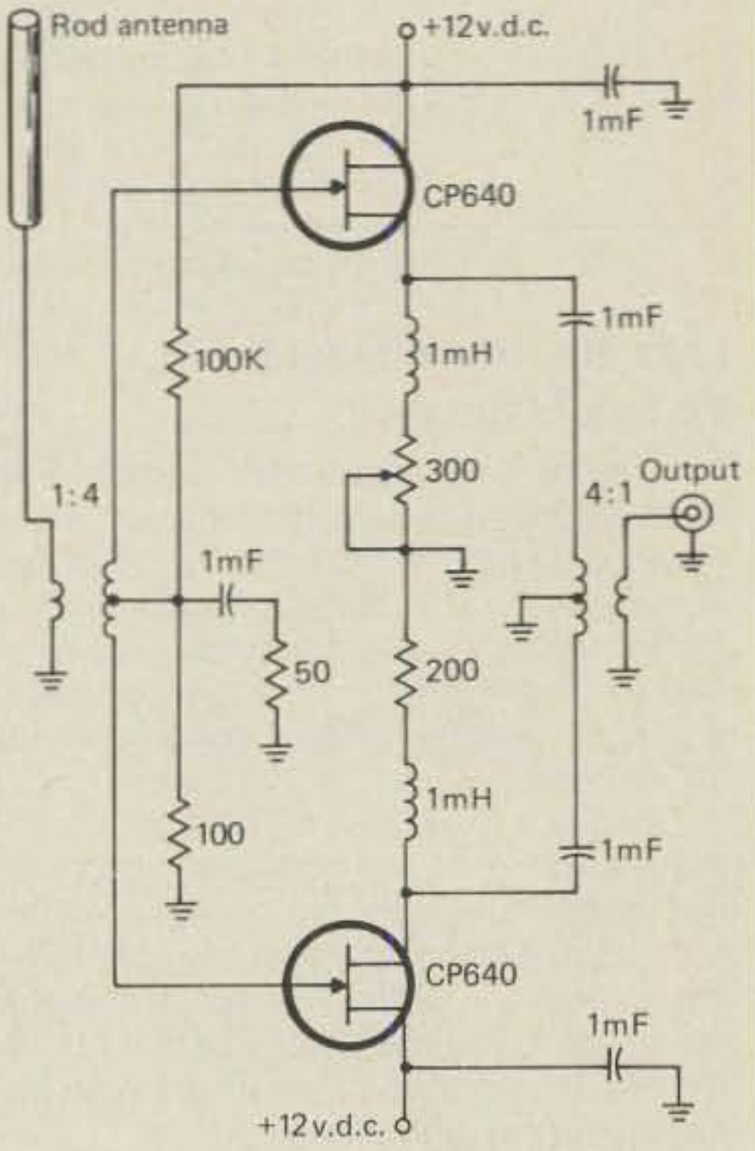


*Fig. 4– A push-pull version of a simple active antenna.*

Finally, the antenna noise figure is

$$F_A = F_{min}\left\{1 + \frac{C}{R_A}\left(R_{opt} + \frac{X_A^2}{R_{opt}}\right)\right\}$$

Using a rod antenna, its impedance is

$$Z_A \approx K_{R_1}\omega^2 + j\frac{k_{X_1}}{\omega}$$

The impedance diminishes much faster than the noise figure does (as a function of frequency). Consequently, optimum matching resistance should be specified at the lowest operating frequency. Consider a 2–30 MHz active antenna. Its match resistance is 2466Ω (at 2 MHz). The antenna performance can now be determined if $Z_A$ is known.

| | |
|---|---|
| a | Cable losses |
| B | Receiver bandwidth |
| C | Noise correlation factor |
| $F_A$ | Antenna noise figure |
| $F_{min}$ | Amplifier noise figure (for best noise match) |
| $F_R$ | Receiver noise figure |
| $F_S$ | System noise figure (antenna, cable, and receiver) |
| $G_v$ | Antenna gain = antenna output power |
| $IP_2$ | Second-order intercept point |
| $IP_3$ | Third-order intercept point |
| $P_a$ | Output power into 50 ohms |
| $P_{am_{2,3}}$ | Second or third order intermodulation products output power |
| $P_{an}$ | Noise output power |
| $V_a$ | Output voltage (terminated in 50 Ω) |
| $V_o$ | Antenna output EMF |
| $Z_A$ | Antenna rod impedance |
| $Z_{opt}$ | Antenna rod impedance (for best noise matching) |

*Table I– Active antenna dynamic analysis terminology.*

| f (MHz) | $G_V$ (dB) | $F_A\left(\frac{dB}{kT_o}\right) \approx F_S\left(\frac{dB}{kT_o}\right)$ |
|---|---|---|
| 2 | – 31 | 47.4 |
| 5 | – 21.7 | 35.2 |
| 10 | – 15.5 | 28.6 |
| 15 | – 12 | 24.9 |
| 20 | – 10.2 | 23.1 |
| 25 | – 7.3 | 20.2 |
| 30 | – 5.5 | 18.4 |

*Table II– Electronic losses and noise figure as a function of freq.*

## Loss and Noise Figure Versus Frequency

Table II lists electronic losses and noise figure as a function of frequency. (This assumes that the noise figure of the active device is 2 dB.) This data is also plotted in fig. 5. In this graph, the system's noise figure, the man-made noise, and some arbitrary noise specifications are plotted.

Despite a loss of 30 dB (the active antenna relative to the power available at the antenna input) the signal-to-noise ratio up to 4 MHz can meet the specifications. Below 4 MHz, the specifications are equal to the man-made noise. Above 4 MHz the antenna's performance exceeds the specifications.

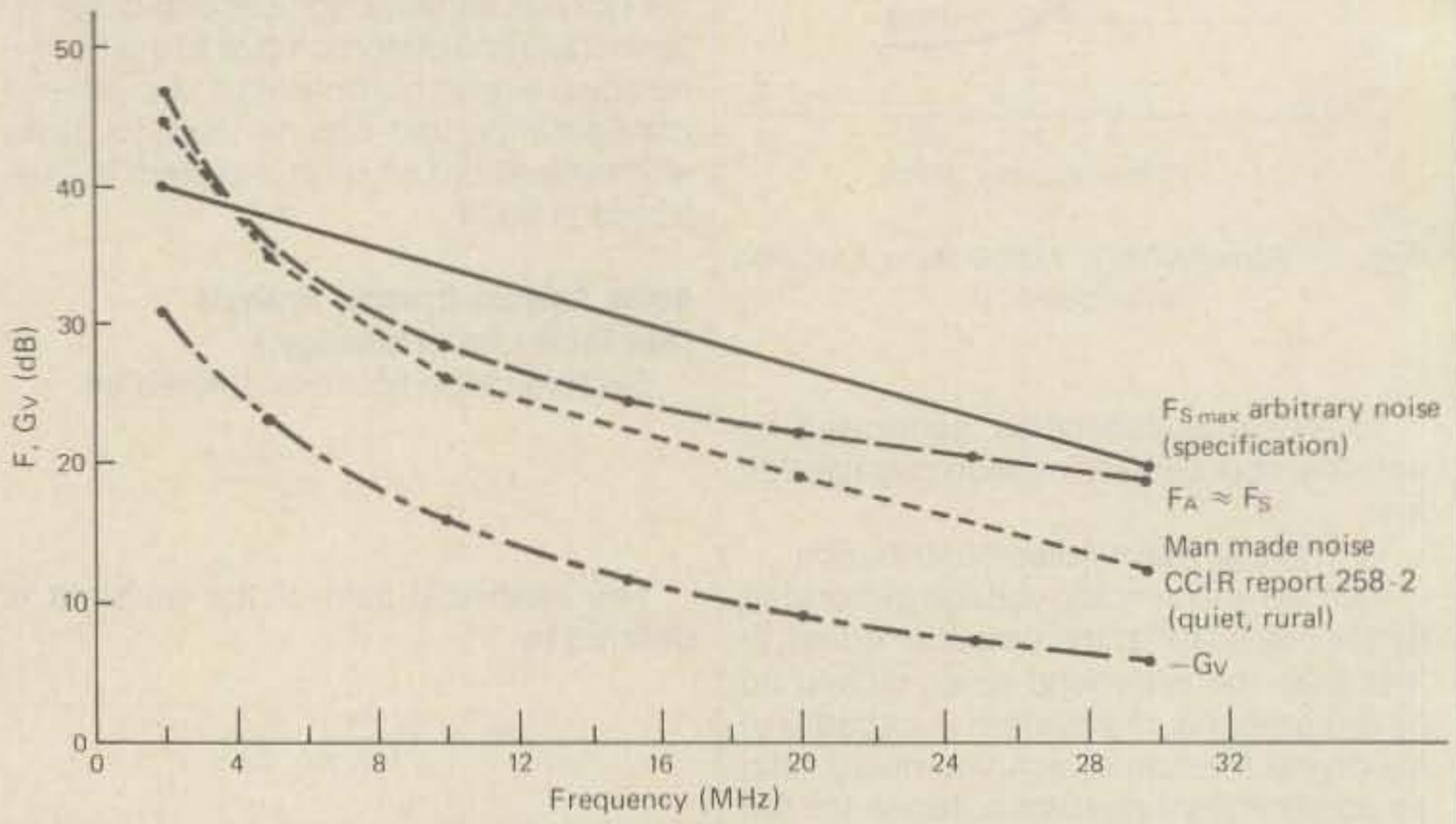


*Fig. 5– The electronic gain and noise figure of the ionosphere, active antenna, and required system noise figure.*

## Shipboard Environment Specifications

The active antenna, per the specifications,[1] sees two 10V EMF's. The intermodulation distortion products that are generated due to these two voltages are 40 dB above the specified maximum system's noise figure, as a worst case condition. Therefore:

$$P_{an}(dBm) = F_S(dB) + G_v(dB) = 10 \cdot \log kToB \cdot 10^3 = F_S(dB) = G_v(dB) - 139\,dBm \text{ and}$$

$$P_{am_{2,3\,max}}(dB) = P_{an\,min}(dBm) + 40\,dB = [F_S(dB) + G_v(dB)]_{min} - 99\,dBm$$

At 2 MHz, $F_S = 40$ dB and $G_V = -31$ dB. Therefore, $P_{am_{2,3}} = -90$ dBm.

[1]*Antenna system developed for use on shipboard by Communications Consulting Corp., Upper Saddle River, NJ, based on some discussions with the Naval Research Laboratory in Washington, D.C.*

## Intercept Point Calculations

$$IP_2(dBm) = 2P_a(dBm) - P_{am\,2}(dBm)$$

$$P_a = \frac{V_a^2}{50\Omega}$$

With $V_a/V_o = 0.5$ and $V_o = 10$V, $P_a$ is +27 dBm, and therefore, $IP_2 = 144$ dBm and $IP_3 = 85$ dBm. These are the two values that are required to generate an intermodulation distortion noise floor at the rated level. For practical considerations the 1 dB compression point should be 10 dB above the operating output level. Therefore, in this case, it should be +37 dBm. This results in a voltage level of 44.3V at 0.9A in a 50 ohm system. The operating voltage of this amplifer should be set at 50V. If the input voltage ratio is changed and a higher than 0.5 voltage division ratio is utilized, then the second and third order intercept points can be reduced. Let us assume that an intercept point of $IP_2 = 100$ dBm and $IP_3$ of 65 dBm can be reached in a practical amplifier. The following results will then be obtained:

1. Second order intermodulation distortion products are going to be –46 dBm and the useful dynamic range will be 84 dB.

2. Third order intermodulation products will be –49 dBm and the useful dynamic range will be 81 dB.

These calculations assume a noise figure of 40 dB at 2 MHz and two 10V random carriers generating the intermodulation distortion products as specified.

A number of tests in extremely hostile environments have already been performed with this active antenna. However, it is not yet in mass production and, therefore, not enough information about reproducibility is available. This will be the next step for evaluation.



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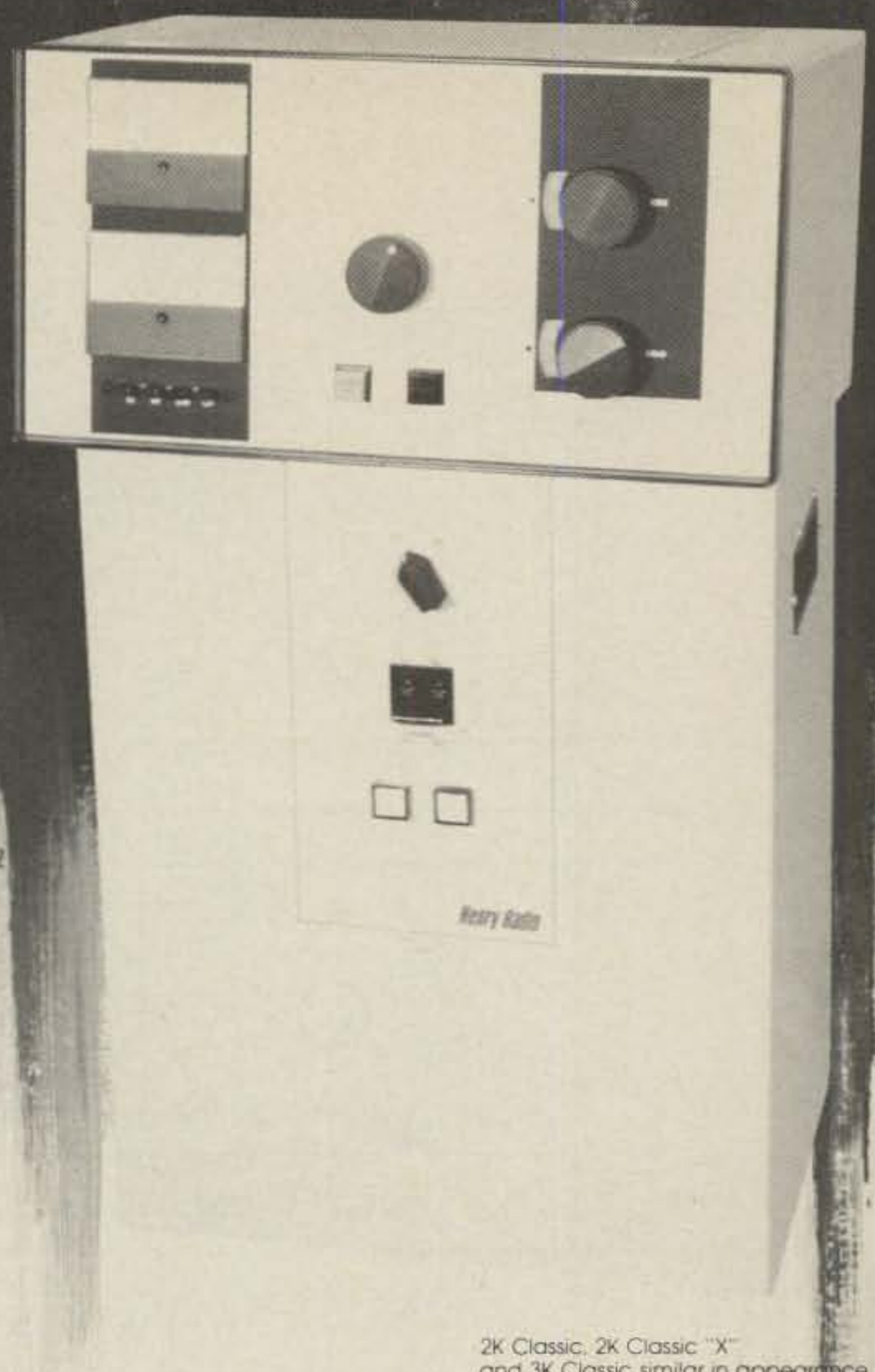

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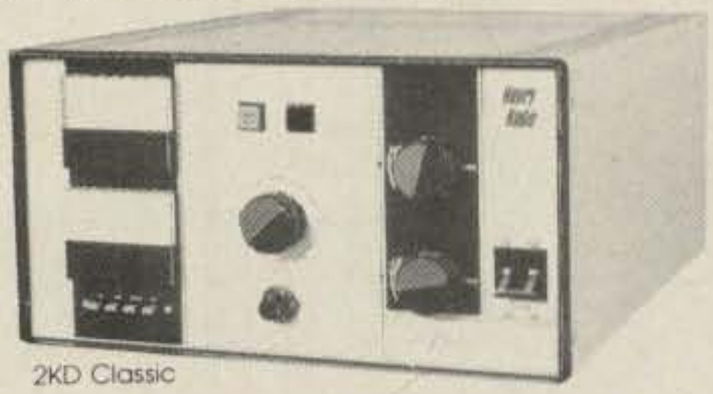

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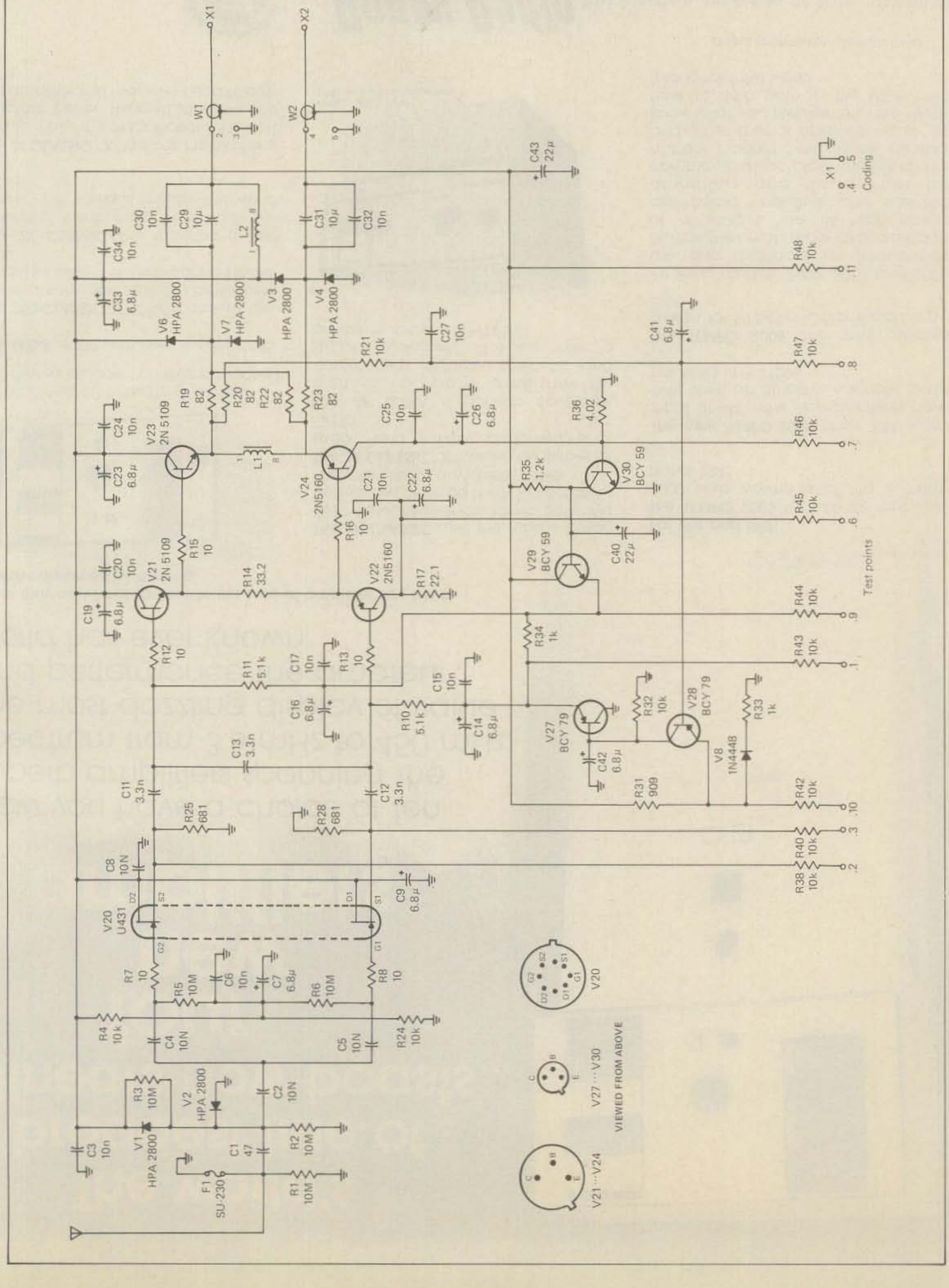


*Fig. 6– Schematic diagram of an active antenna.*

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*In Part II we take up with scope modification and the actual procedures for monitoring modulation.*

# Practical Ideas On S.S.B. Modulation Monitoring

## Part II—Conclusion

BY JOHN J. SCHULTZ*, W4FA

*Part I of this two-part series appeared in the October 1982 issue of CQ on page 36. We take up this concluding part with a discussion of scope modifications in order to use a typical oscilloscope as a modulation monitor.*

An inexpensive low-frequency oscilloscope can be modified to serve as a good modulation monitor. However, one may wonder whether to go this route or to purchase one of the s.s.b. or "Station Monitors" on the market. If one does not have an oscilloscope already and likes to do a bit of circuit experimenting besides having a modulation monitoring capability, the purchase of a good, basic oscilloscope might be considered first. Some of the easy modifications to be described will allow it to function as a modulation monitor, and one always has a regular oscilloscope available for good general-purpose testing, trouble-shooting, etc. The performance of a basic oscilloscope for a given amount of money is usually much greater than that of the "basic" oscilloscope contained in a station monitor in terms of frequency response, sweep frequency ranges, etc. Of course, the advantage of buying a station monitor is that one gets everything complete and set up for modulation monitoring with a slight capability of using the instrument for general-purpose measurements. Some commercial monitors even come complete with built-in two-tone test generators.

If one elects to modify an inexpensive oscilloscope with a limited frequency range (as far as its vertical amplifier is concerned), one has to get the r.f. signal directly to the vertical deflection plates on the CRT. One very neat way is shown in fig. 4. The adapter couples a small amount of r.f. from a coaxial transmission line. The broadband ferrite core coil acts as a broadband unbalanced to balanced transformer so equal amounts of r.f. are applied to each deflection plate. Also, this arrangement permits the use of the r.f. chokes shown in each deflection plate

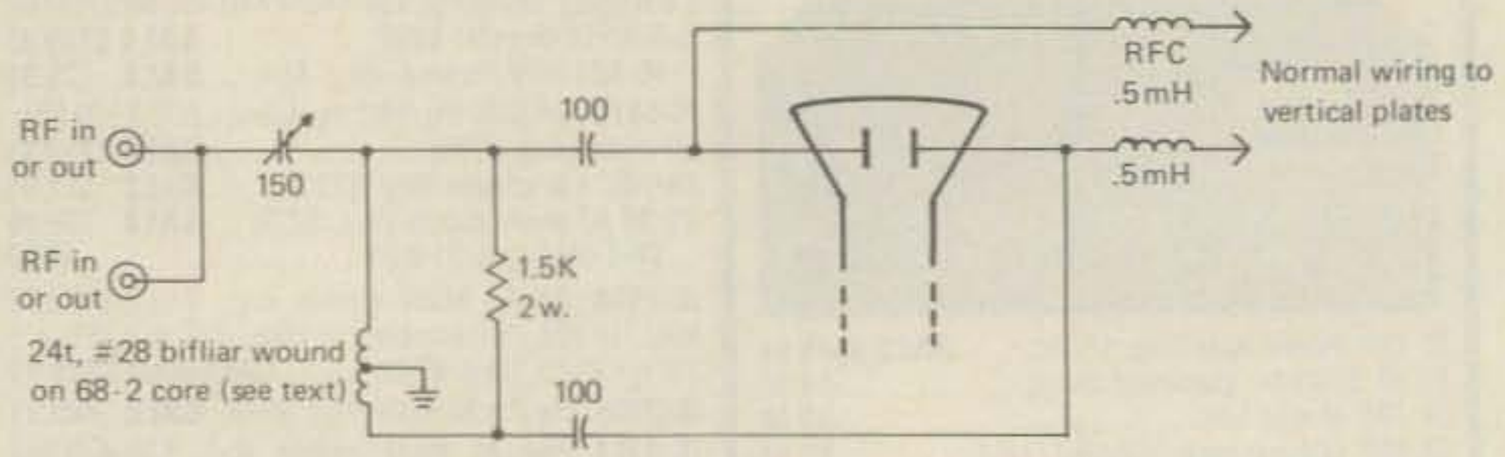


*Fig. 4– A simple adapter unit that will allow a simple oscilloscope to be used for s.s.b. monitoring without affecting its normal operation as a test instrument.*

lead which goes to the regular wiring for the deflection plates in the oscilloscope. So, no switching is needed when using the oscilloscope in its normal manner or for s.s.b. transmitter monitoring.

Since r.f. is involved, the adapter circuit should be constructed as compactly as possible and located directly at the CRT socket. The method of doing this will depend on the oscilloscope involved. However, remember that the 150 pF capacitor need only make a single point contact with the center conductor of the coaxial line. So, if two SO-239 connectors are mounted on the rear of an oscilloscope for r.f. connections, *shielded* coaxial cable should be used for the run in the oscilloscope to and from the 150 pF variable. A means must also be provided for controlling the 150 pF variable by means of an insulated shaft coupling. The 150 pF variable only provides a means for varying the r.f. pickup on various bands and its setting is not critical. Therefore, it can be replaced, if desired, by a simple rotary switch which taps along a series string of 10 or more fixed mica capacitors which build up in value from less than a pF (two insulated wires twisted together) to a 150 pF capacitor.

The winding of the ferrite core is not difficult nor critical. First twist together two lengths of about #28 AWG enamel wire. Use wires of different enamel colors or otherwise identify the ends of each wire. Put on about 24 turns of twisted pair evenly spread around the core. Solder any two wires of different colors or oppositely marked ends together to form the ground lead. The two remaining wires are, of course, those which are connected across the 1500 ohm resistor shown in fig. 4. The adapter unit will be effective on all the h.f. bands (80–10 meters) and with transmitter power levels of about 50 watts on up. The latter depends, of course, on the particular CRT used in an oscilloscope.

The setup used for checking an s.s.b. transmitter is shown in fig. 5. Any speech processing equipment used is bypassed. The two-tone test oscillator is fed into the microphone input and the r.f. coupled to an oscilloscope either directly, if the oscilloscope has sufficient bandwidth, or via the adapter just described. Place the

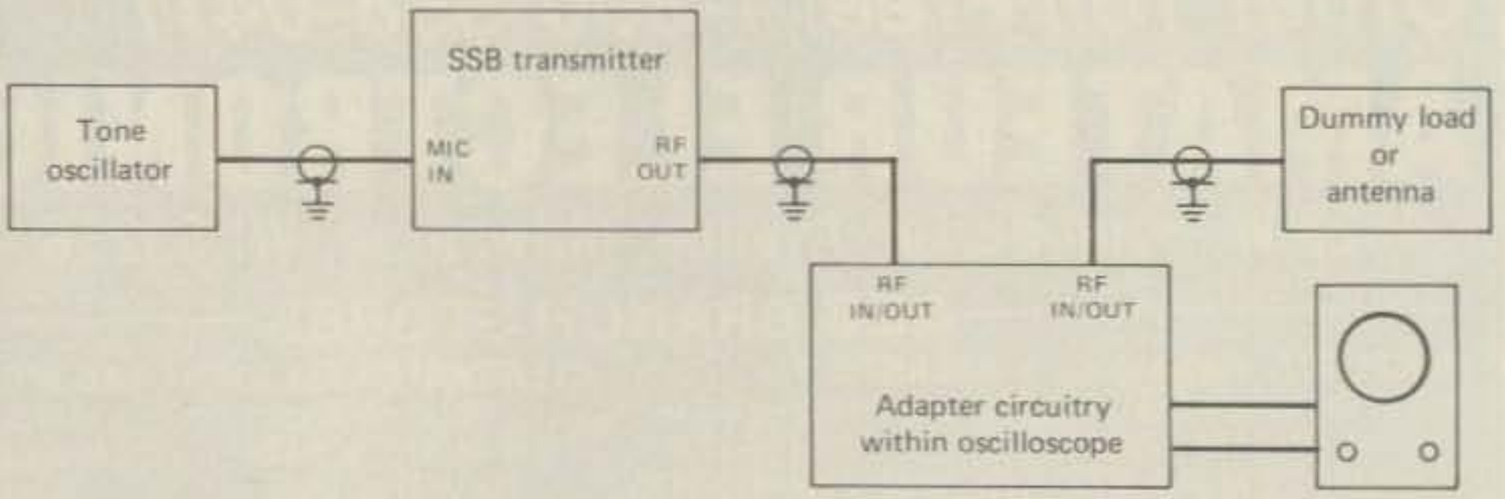


*Fig. 5– Final testing and monitoring setup using the adapter circuitry of fig. 4.*

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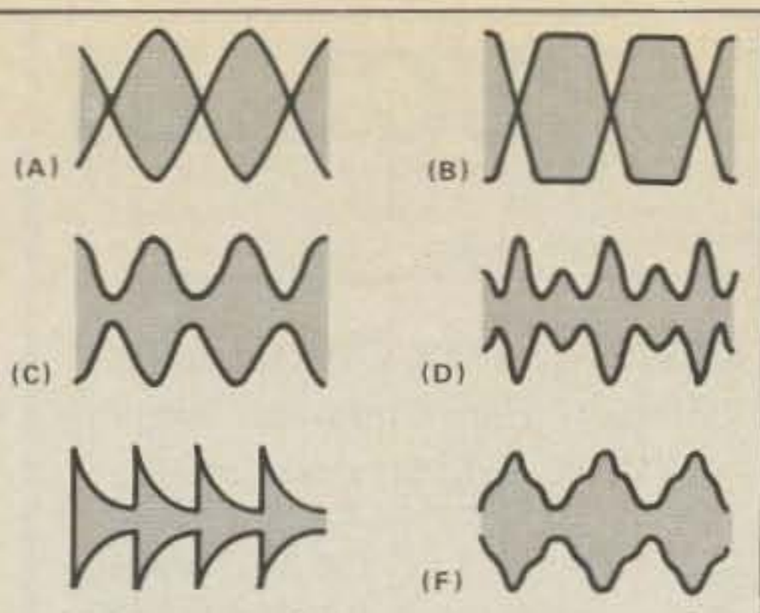
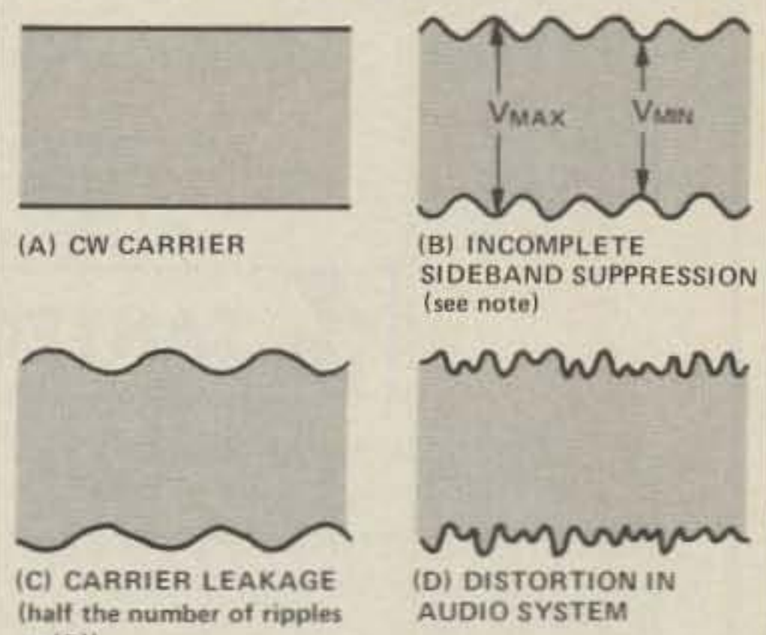



*Fig. 6– Some of the scope patterns that may be obtained when using a two-tone or speech input to an s.s.b. transmitter. The patterns are discussed in the text.*

sweep frequency of the oscilloscope in its lowest range. Possibly the instruction manual for a given transmitter may give some data as to what the loading conditions can be when using a two-tone test. If not, adjust the two-tone level until the transmitter is loaded up to about 0.7 of the rated c.w. input. If everything has gone well, one should observe the patterns of fig. 6(A). If, however, a pattern similar to fig. 6(B) is obtained, the transmitter is either being overdriven and one has to back down on the two-tone input level, or the output stage is not loaded properly. If one has to back down too far on the two-tone input to get a clean pattern, one might suspect the transmitter of not being able to generate its rated PEP. The plate or collector current ratios that should exist for the same PEP output are c.w.:1:1, two-tone test: 0.7:1, speech input: 0.5:1. That is, if the current drawn is rated at 800 ma for c.w., one should be able to adjust the two-tone level such that approximately 560 ma is drawn and obtain a clean pattern. The two-tone test might produce some other patterns also. The pattern of fig. 6(C) indicates an incorrect bias voltage. Fig. 6(D) indicates carrier leakage.

The maximum deflection that can be obtained on the oscilloscope before the pattern of fig. 6(A) turns into that of fig. 6(B) establishes how hard the transmitter can be dirven before non-linear operation and splatter will result. The actual PEP output can be calculated, as mentioned at the start of the article, if one is using a wideband, calibrated oscilloscope. If one is using the adapter to couple into an oscilloscope, the display would have to be calibrated once using a borrowed oscilloscope or r.f. voltmeter. When speech input and/or speech processing equipment is used, that maximum deflection or PEP should not be exceeded. The types of patterns one can expect with speech input are shown in fig. 6(E) and (F). The first pattern is for normal operation, and the second one shows that the transmitter is just starting to be slightly overdriven. Kindly back down a bit on that microphone gain!

By using only one tone of the two-tone generator, one can obtain patterns that may indicate some problem in a transmitter. With one tone a pure c.w. signal should be generated as shown in fig. 7(A). If there is some noticeable lack of sideband suppression, the pattern of fig. 7(B) will result. The sideband suppression can actually be calculated using the formula shown next to the pattern. Note that it is not necessary to have a calibrated oscilloscope to do this. Only the relative value of the two peak-to-peak voltages indicated is necessary. Fig. 7(C) shows a possi-




NOTE:

$$\text{Suppression (dB)} = 20 \log \frac{V_{MAX} + V_{MIN}}{V_{MAX} - V_{MIN}}$$

*Fig. 7– Some of the patterns that may be observed during single-tone testing.*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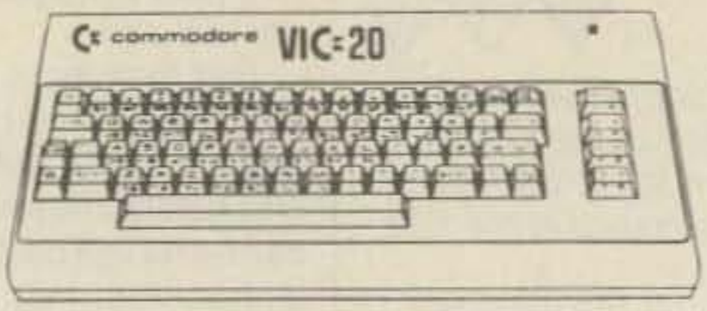


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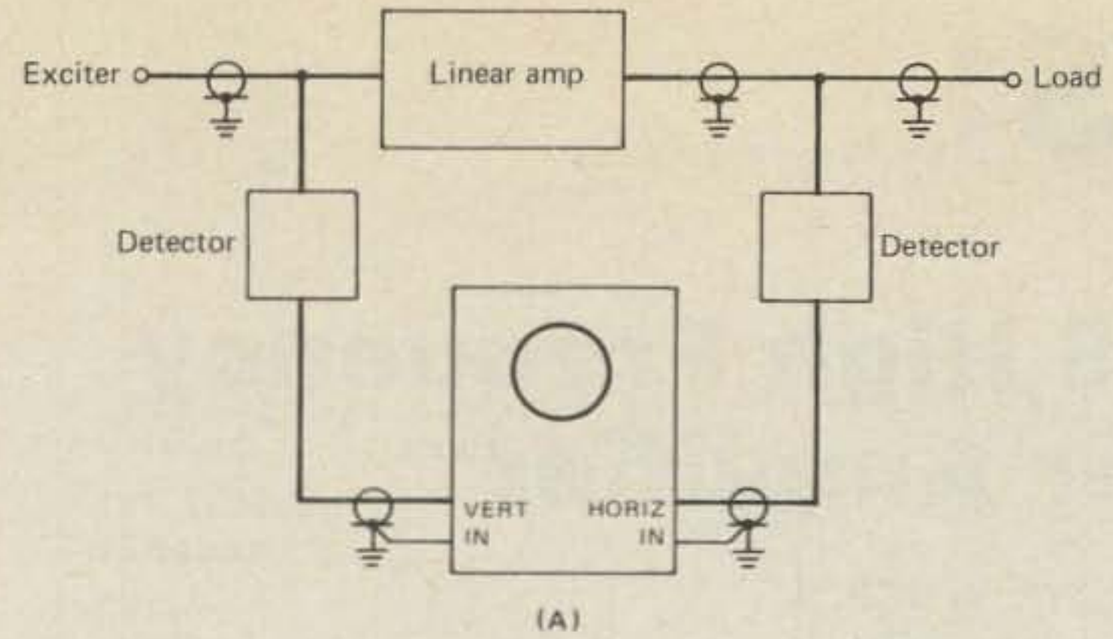


*Fig. 8– Input/output detector method for checking a linear amplifier. The circuitry for one detector unit is shown.*

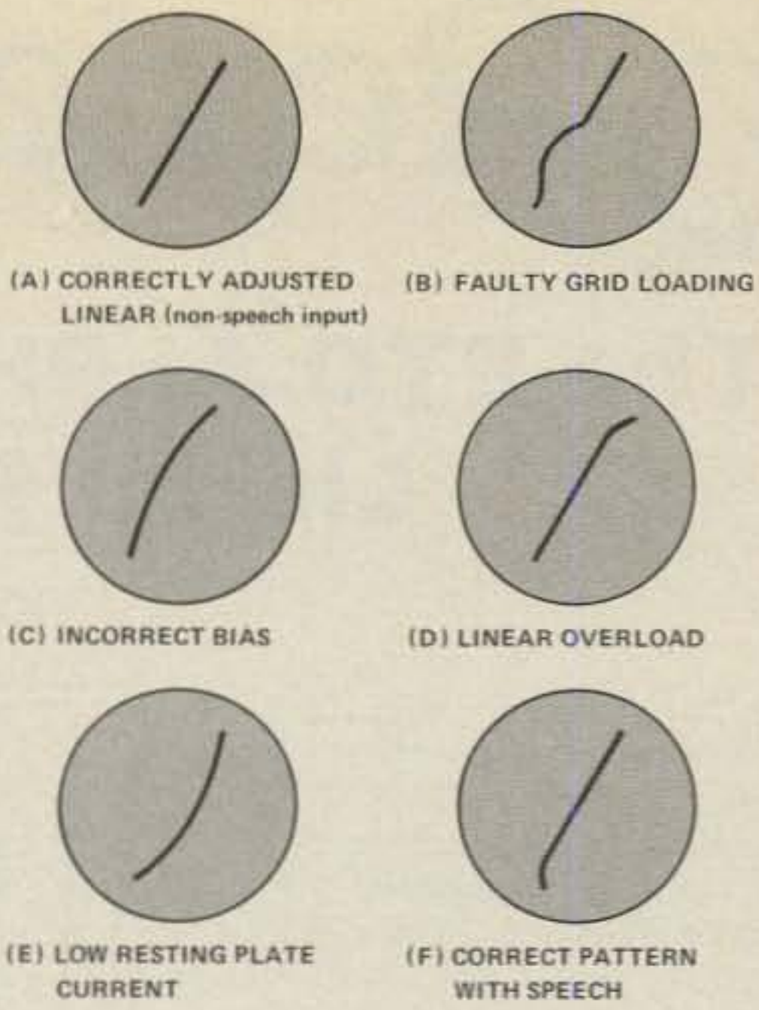


*Fig. 9– Some of the patterns obtained using the setup of fig. 8.*

ble case of carrier leakage. The pattern of fig. 7(D) might indicate some distortion in the audio chain or a problem in a balanced modulator.

The foregoing monitoring setup using the two-tone test as a reference is probably the easiest and most effective one for most amateurs to realize. This is particularly true if one has a commercial transceiver and does not want to do any "digging" inside the equipment. However, amateurs who have separate linears or who like to experiment should be aware of another approach for s.s.b. monitoring. The basic setup for this approach is shown in fig. 8. Two envelope detectors or demodulator circuits are used: one to sample the r.f. at the input of a linear and the other to sample the output r.f. The outputs of the detectors are fed to the horizontal and vertical inputs of an oscilloscope. A fairly good quality oscilloscope is needed—on the order of the 5 MHz bandwidth types. If the linear is operating in its linear region, the pattern displayed will be a straight 45° line. It is interesting to note that this will be true regardless of the type of modulating signal: one tone, two tone, or voice. So, no additional test equipment is necessarily needed when using this method of monitoring.

A few practical points have to be watched if one wants to practically implement this method. The schematic of a detector unit is also shown in fig. 8. They should be constructed in separate shielded enclosures even if they are located inside a linear amplifier. First, the input to the detectors is connected in parallel, and a resistive voltage divider is used on the input to each detector which is connected to the input coaxial line to the linear. Start with several kilo-ohms resistance for R1 and R2. Then by experimenting with the divider resistances and the gain control settings on the oscilloscope, one should be able to obtain a straight-line pattern. One detector is then moved to the output side of the linear, and either by increasing R1 or by using a pickup loop instead of direct connection to the output, a line pattern is obtained without having to make any significant changes in the oscilloscope's gain control settings.

Admittedly, this method requires a bit more care in setup than the two-tone method, but it is also capable of giving a somewhat clearer indication of transmitter performance. For instance, fig. 9 shows some of the patterns obtained under normal and abnormal operating conditions.

Finally, the last method just described can be used to check transmitter operation between *any* two points in the r.f. amplification chain after an s.s.b. signal is generated. So, one could, if desired, check the overall linearity from the output of the s.s.b. filter in a transmitter to the output of a linear amplifier. Since envelope detectors are used, the fact that the s.s.b. signal may be at different frequencies in different stages of the transmitter does *not* matter.

Whatever scheme of monitoring is used, one will find operating a great deal more satisfying by knowing that one is getting maximum performance out of a transmitter without going to the extreme of causing unnecessary splatter. ■


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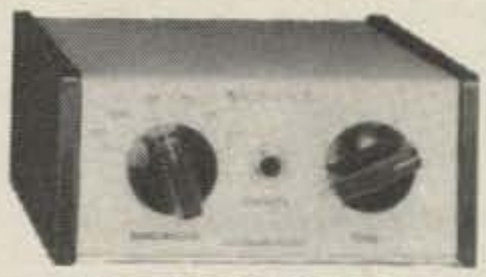

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# CQ Reviews:

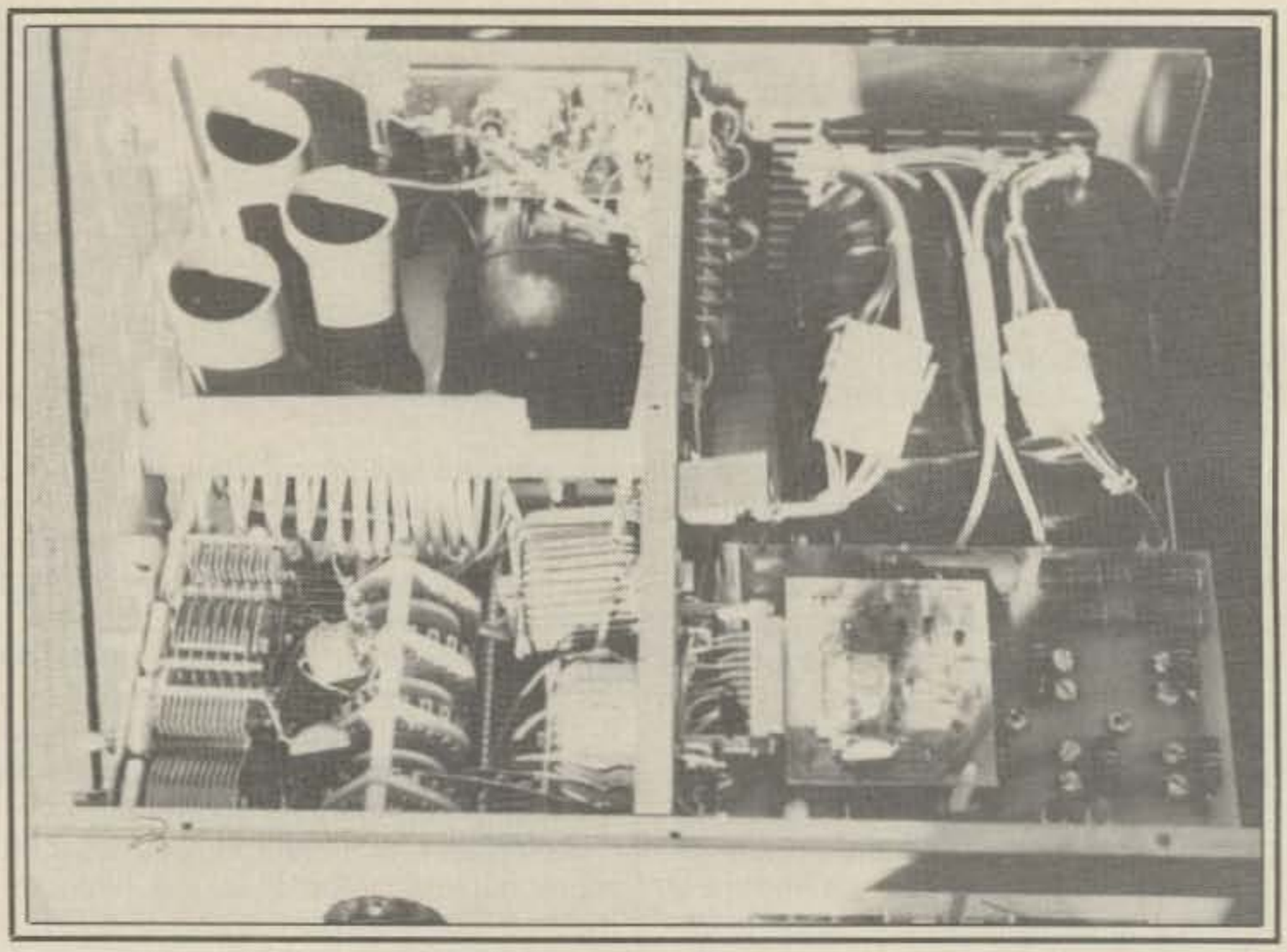
# The ETO ALPHA 78 High Frequency Linear Power Amplifier

BY LEW McCOY*, W1ICP

You won't find many amateurs who will disagree with the statement that Erhorn Technological Operations, Inc. (ETO) produces exceedingly fine products. This reviewer has always considered the ALPHA amplifiers in the "Rolls Royce" class of equipment. Having built many power amplifiers in my career, it is safe to say I think I know a good one when I see it. The ALPHA 78 described in this review certainly fits the category of "good" and then some. If one is going to design an amplifier for general use in the hobby, consideration must be given to the different types of drivers that may be used, plus the many kinds of operation amateurs now use, such as s.s.b., c.w., TTY, and Slow and Fast Scan, to name only a few. These points plus operating convenience and reliability are just a few things that must be considered. Dick Erhorn, who designed the ALPHA 78, is an amateur who has been active a great deal using all the modes mentioned, so he knows the needs that must be filled.

The ALPHA 78 is conservatively rated at 2 kw PEP/s.s.b. input with driver powers in the 100- to 140-watt range and 1 kilowatt continuous (key-down) for c.w. or TTY with 60 to 80 watts of driving power. Frequency coverage includes the 1.8 through 21.45 MHz amateur bands. One feature is the provision for using the amplifier without tune-up on 80 through 15 via factory-preset controls as long as the antenna system presents an s.w.r. load of less than 1.5 to 1 on each band.

The power supply is built-in utilizing a Hipersil transformer with a nominal rating of 2.4 KVA continuous commercial duty. For those who haven't heard the word *Hipersil*, it is the trademark name for an iron material that greatly reduces the iron size requirements for a given power rating, which provides a much smaller but more efficent power transformer. High-voltage d.c. is obtained via a full-wave bridge rectifier with 35 uF of filtering. The transformer is shipped in a box separate from the amplifier, and it takes about 15 minutes to install it in the amplifier; no soldering is required. Also, cabinet interlock switches are installed in the lid so the high voltage is killed when the lid is removed. A relay, panel controlled, is used to select high (**SSB**) or low (**CW**) plate voltages for the three 8874 ceramic, parallel-connected, grounded-grid triodes which are used.



*An inside view of the amplifier. At the left rear are the three tubes with the blower just to the right. In front of the tube compartment is the tank circuit with its associated coils. At the right rear is the power transformer, and to the front, the break-in system.*

The cabinet measures 7½ inches high by 17 inches wide by 15 inches deep. Total weight, including the power transformer, is 70 pounds. The cabinet is finished in an attractive brown suede paint.

## Operating Features

The three 8874's are operated in a class AB2, grounded-grid configuration. A Pi-L output tank circuit is used for the tubes, providing very good harmonic rejection—typically −50 dB, far exceeding FCC requirements. Input to the amplifier is via an r.f. matching network with a nominal 50 ohm impedance. The input and tank circuit design reduces third-order intermodulation distortion better than 35 dB below 1 kilowatt PEP output.

The amplifier is set up so that either manual or pretuned conditions can be met. When **Manual** tune is selected, the bandswitch connects the manual tune and load capacitors. When one of the **Bandpass** ranges is selected, factory-preset variable and fixed capacitors are switched in. If you like contest operating, or are just plain lazy as I am, this means a lot of tune-up time is eliminated. Just switch and operate. Th is is a very nice feature to have.

By the time this review appears, it is likely that the FCC will have changed the requirements for measuring power input to include power output measurements. If so, the ALPHA 78 has a built-in r.f. wattmeter that will help keep the operator legal as far as the rules are concerned. It is not planned to get into a discussion on exactly what PEP (**P**eak **E**nvelope **P**ower) is, but a few words might help the uninitiated to understand. If one were to use an oscilloscope to view the output of a transmitter and turn the transmitter on, key down, an r.f. envelope would be observed on the scope. From the top to the bottom of that envelope would be the total r.f. out-

*200 Idaho St., Silver City, NM 88061



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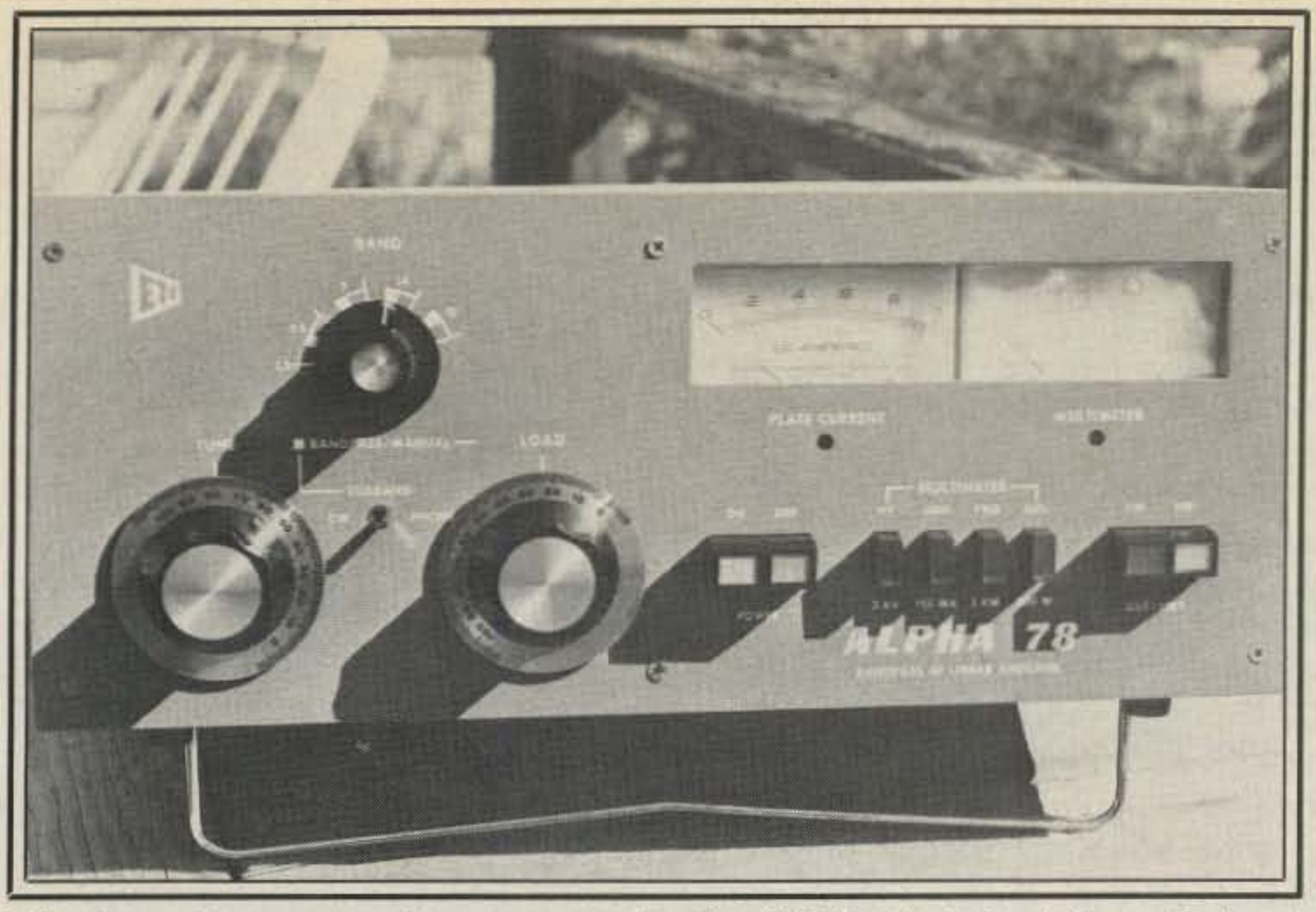


*This shows the neat panel arrangement for the ALPHA 78. At the left are the band-switch and tune and load controls plus the c.w./phone switch. At the right are the power and metering switches.*

put. Let's say that the envelope is six divisions on the scope. If you now switch to s.s.b. and talk so that your voice peaks reach the top and bottom of the points where the envelope was, or a total of six divisions, then that is your "peak envelope power."

Many amateurs believe that 1 kw input equals 2 kw output, but this is not true. It is almost impossible to relate input to output power—exactly, that is. Additionally, no r.f. power bridge that I know of will provide a completely accurate PEP reading simply because even with delay circuits built in, it is almost impossible to obtain an exact reading. This is because the response time of the circuitry and meters used in bridges is not fast enough. In the instruction manual for the ALPHA 78 they are careful to point this out. In fact, I'll quote the pertinent point: "Due to the meter's (ALPHA 78 panel meter) ballistic characteristics, the Multimeter will approach but never quite reach a true PEP indication—hence the term **semi-peak reading.**" And, I might add, this is true of most, if not all, wattmeters. I might also add that this is not a point to worry about when the FCC rule changes are made. The FCC will be providing guidelines for r.f. power output measurements, and I am sure they will take the errors in wattmeter readings into consideration.

The ALPHA 78 has two panel meters. The first is used to constantly monitor plate current for the tubes. Another meter, called the **Multimeter**, takes care of grid current, plate voltage, and r.f. output (reflected and forward powers).

Another operating feature, at least to me, is the tuning knobs on **Tune** and **Load** controls, which are vernier driven. These provide very smooth and precise tuning of the amplifier in the **Manual** position.

Last, but by no means least, is the full break-in system (QSK) that is built into the amplifier. To go into full details would be too much for this review, but to be sure, the amplifier will provide break-in opera-




*Fig. 1– The QSK (full break-in) T/R system for the ETO ALPHA 78.*

tion as fast as or faster than the exciter used. Again quoting from the very excellent instruction manual that accompanies the amplifier: "Overall operation of the break-in system may be summarized simply as follows: on 'make' (closure of the external **Relay** line by key, PTT, VOX, or other contacts), closure of the exciter **Key** circuit via J8 is delayed long enough for main vacuum T/R relay K5 to close, and to insure that no r.f. drive is present at the amplifier r.f. input at the time. Keying speed is limited only by the closing time K5 (about 2.0 msec) and of K11 (about 0.5 usec) and by the 'break' shaping of the exciter keying characteristic. Full break-in keying is possible with speeds well in excess of 50 w.p.m.—provided the exciter has equivalent capability!" (See fig. 1 for QSK circuit.)

The instruction manual is very detailed, providing complete circuit drawings. Also, there is profuse information on trouble-shooting, although it would seem that the user would really have to abuse the amplifier to have it come up with troubles. As mentioned earlier, the amplifier would fit into the "Rolls-Royce" category. In this reviewer's opinion, on a scale of 1 to 10 the Alpha 78 would have to rate a 10.

For additional information, write to Erhorn Technological Operations, Inc., Canon City, Colorado 81212.


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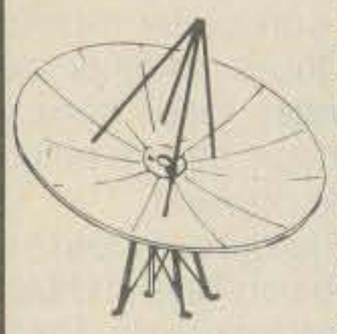

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# The "5 For 5" 2 Meter Antenna

**BY DAVID F. PLANT*, N7CGA**

After whetting our whistles on 2 meters using a hand-held and outdoor vertical, the time rapidly came to experiment with nonrepeater QSO's. The thought of having more relaxed ragchews and experimenting with ground wave using the simplex mode became more and more attractive.

The obvious answer (other than building a power amplifier and receiver preamp) was to erect a gain-type antenna. The question was where to buy the aluminum tubing and fittings specified in the existing literature, especially when the next day was Sunday and this was already Saturday evening.

The "5 for 5" (5 elements for $5.00) was built that Sunday. Following successful testing of the prototype, 12 more Yagi's were produced with the able help of John, N7AHX. I kept two for stacking and another pair for playing, John took two, and the others quickly found homes, including ARES work. Naturally, at $5.00 each, no cash discounts were allowed.

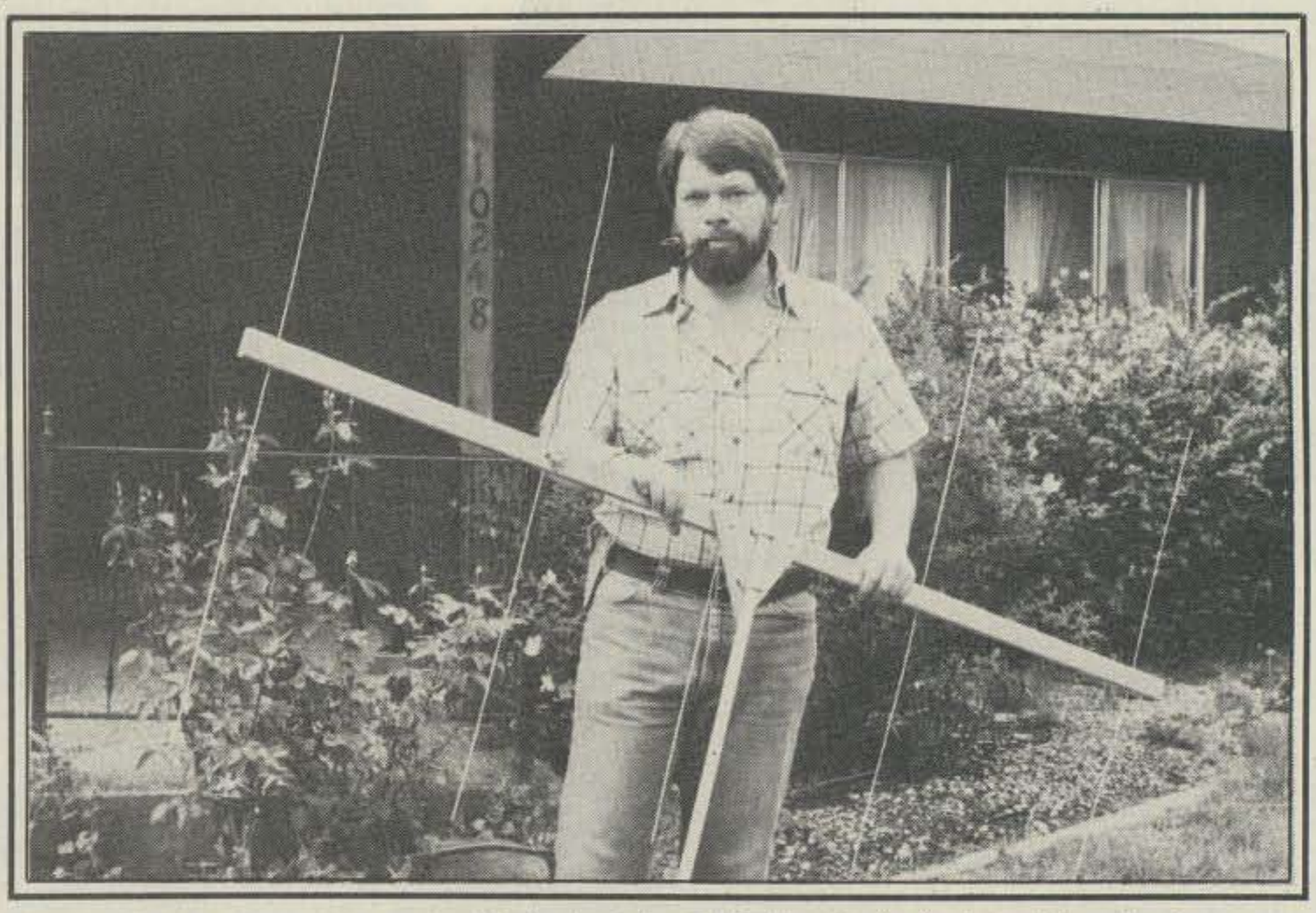

*Photo of the author with an individual "5 for 5." This Yagi, designed for single mounting, will give a forward gain of 9 dB.*

## The Design

The individual Yagi's are constructed with a standard 6 foot length of 1 × 1½ inch lumber as the boom, and #12-gauge galvanized wire as the elements. The wire comes in 50 foot coils for $2.75 and the boom runs about $1.00 for a clean piece. The boom fits the five elements well and allows for proper spacing to yield an approximate gain of 9 dB. This gain is equivalent to doubling the transmitter output power three times; ie., a 2 watt transmitter will have an effective radiated power (ERP) of 16 watts (in the beam's pointed direction).

Receiver sensitivity is also increased by this amount, and stacking two of these Yagi's will give an additional 3 dB of gain which will again double the ERP, giving 32 watts in the above example. The narrow elements give a sharper bandwidth, but this problem is overcome in the matching system.

After experimenting with different feed systems, two were found to be the easiest to build and adjust. The first is a conventional gamma match with a capacitor to tune out reactance in the feed cable. This is the classic approach and results in a flat s.w.r. at the design frequency of 146.0 MHz. The 1.5 to 1 points are 145.0 and 146.5 MHz. Beyond these frequencies the s.w.r. rapidly increases to 3 to 1 at 144.0 and 147.0 MHz. As shown in the graph (fig. 1) this feed system is best if a restricted operating range is planned.

The matching system I chose is a modified gamma called an omega match. Here a small capacity is introduced between the gamma arm and the driven element by placing them closely parallel. My results were broader tuning at a cost of a small increase in s.w.r.

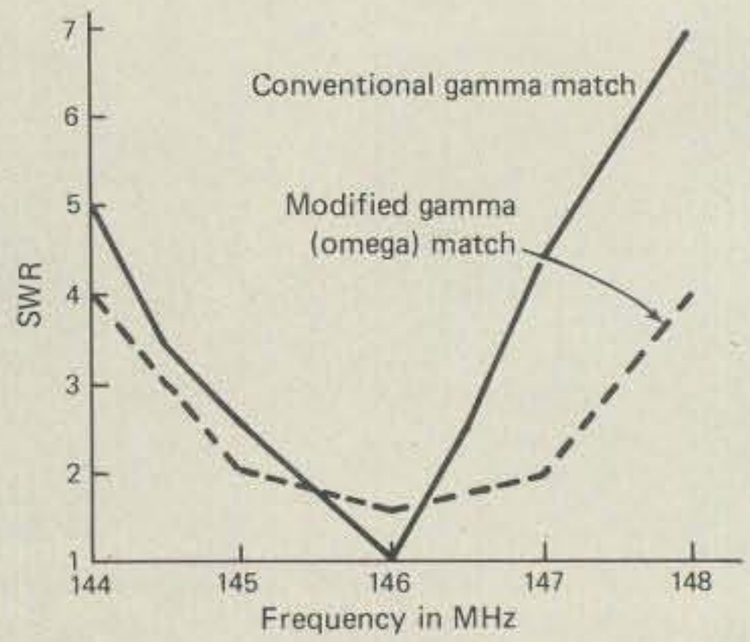


*Fig. 1– S.w.r. versus frequency curves. Readings were taken with Bird Model 43 Thruline wattmeter.*

The gamma match is shown in fig. 2. The plastic tube that insulates and properly spaces the network is made from a 19¢ ballpoint pen with its ink tube remov-

*10248 N.E. 120th St., Kirkland, WA 98033



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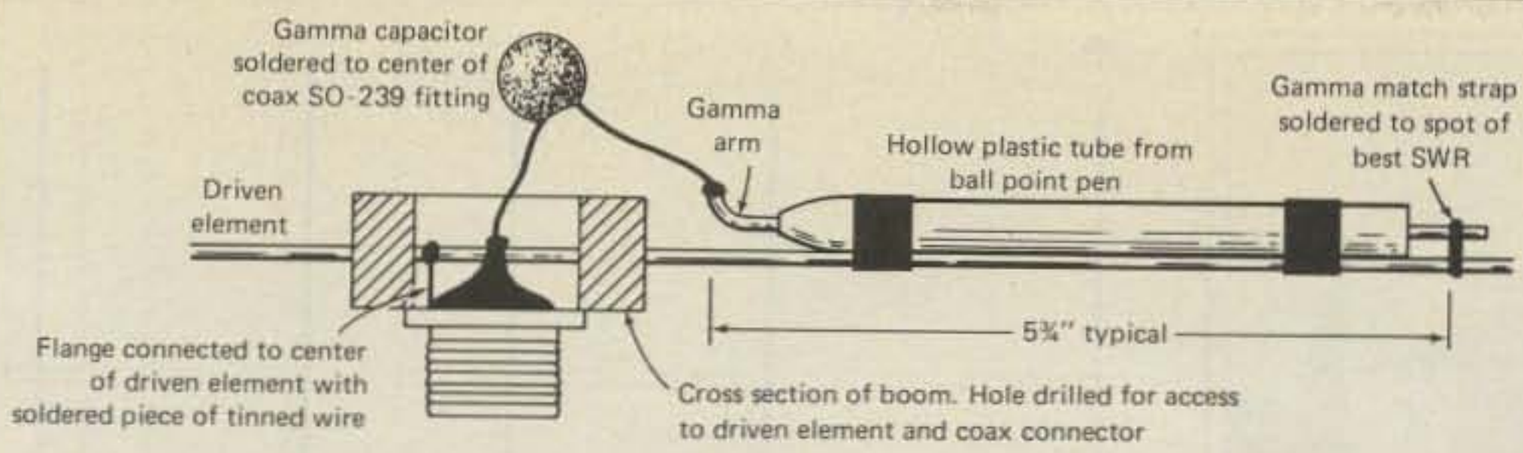


*Fig. 2– Gamma/omega match assembly.*

ed. The assembly pulls out easily with a pair of pliers, and the end cap can be poked out with a piece of stiff wire.

The gamma match capacitor, C1, used to tune reactance from the coax line is generally an air-spaced variable unit in the 10–50 pF range for 2 meters. Using one of this type, I found that the best s.w.r. was obtained with the plates approximately 80% meshed. Fixed-value capacitors were then substituted and 39 or 43 pF gave an equal reading.[1] The larger value of the two gave a slightly better s.w.r. at the low end of the band, and the 39 pF was slightly better at the 146 MHz band midpoint chosen.

The fixed-value gamma capacitor approach solves mounting and weather-sealing problems, and in keeping with the spirit of the project, costs far less. A higher Q mylar is probably the best, although ceramic disks have been used successfully. The shorting strap is made from several turns of tinned hookup wire that are soldered in place at the position of best s.w.r.

As the Yagi is basically a "Plumber's Delight" in design, all elements, including the driven one, can be grounded at their midpoint. This allows a variety of materials available for use as the boom. Among the most common are aluminum, bamboo pole, and PVC pipe. Copper tubing can also be used.

Use of materials other than wood may require a clamping arrangement to hold the elements in place. Fig. 3 illustrates some common methods. Wood gives the benefit of not requiring clamping, as it expands around the elements and holds them tightly. Its disadvantage is that this inherent clamping action detracts from the antenna's value as a take-apart portable. Naturally, the wood boom could have larger holes drilled for a looser element fit and removable clamps could be used.

## Construction

Building the antenna involves drilling five holes for the elements per fig. 4 and larger feed connection holes for the driven element. Don't insert the elements until all drilling and mast mounting operations are completed.

A 3-inch piece of element wire makes a perfect-size hole for the elements if a tight fit is desired. The gusset plate(s) are made of ¼-inch plywood sawed into triangles about 10 inches on a side. Use marine or outdoor-quality wood. The "U" clamps are mounted through the gusset plate and mast and should be of an appropriate size and length to fit the mounting mast. "U" clamps are also used to fasten the booms to the spreader leg with the "5 for 5" array. I used aluminum-color spray paint for the antenna. Its value as a preservative is questionable, but it did spruce up the appearance.

Access to the center of the driven element for the coax connector ground is accomplished by drilling a ⅜-inch hole through the boom centered over the driven-element location. When the element is inserted, it can be accessed for a short soldered connection to the coax connector flange. The coax connector is mounted over a ¾-inch hole drilled immediately adjacent to the ⅜-inch grounding hole and positioned so one flange mounting hole of the connector fits over the grounding access. The connector is mounted with three wood screws in the remaining openings. Grounding the shield side of the feed, soldering the gamma capacitor, and tentatively fixing the gamma shorting strap completes construction.

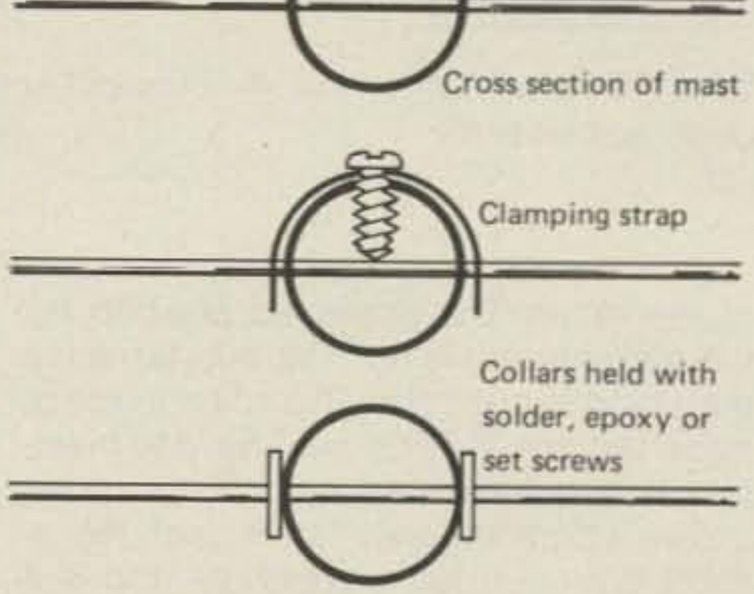


*Fig. 3– Clamping methods for holding elements to the boom. Illustration shows a tubular boom, but the same method works with wood.*

[1]*Confirmed measurements made with Data Technology Model 21 Capacitance Meter across variable C1.*


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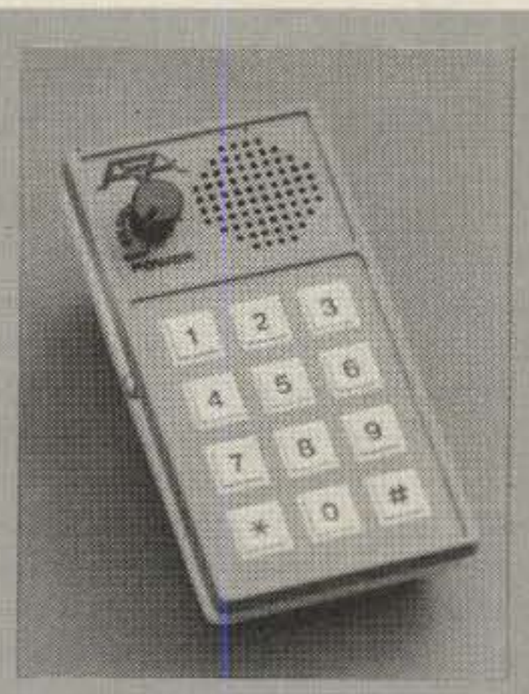

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*Education Technology & Services, see page 81 October 1981 issue of Ham Radio Magazine.

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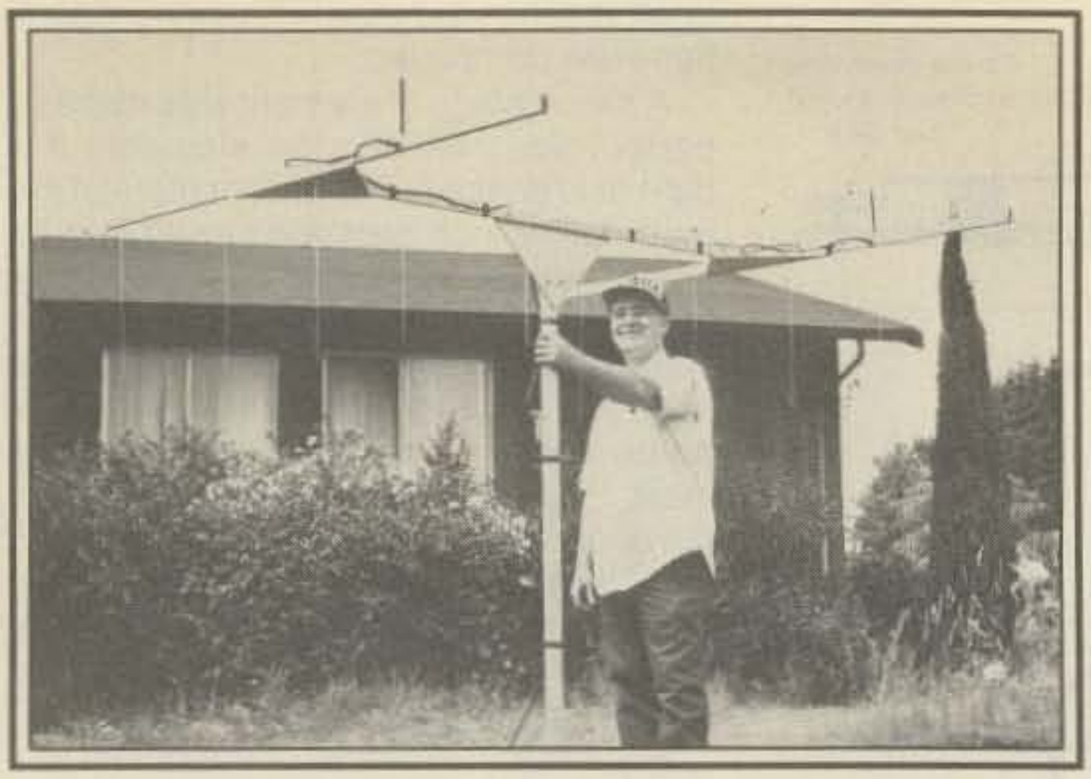

*John, N7AHX, supporting an array built from two "5 for 5's" for a system gain of 12 dB. Note the larger triangular gusset plate and provision for a thicker mast.*

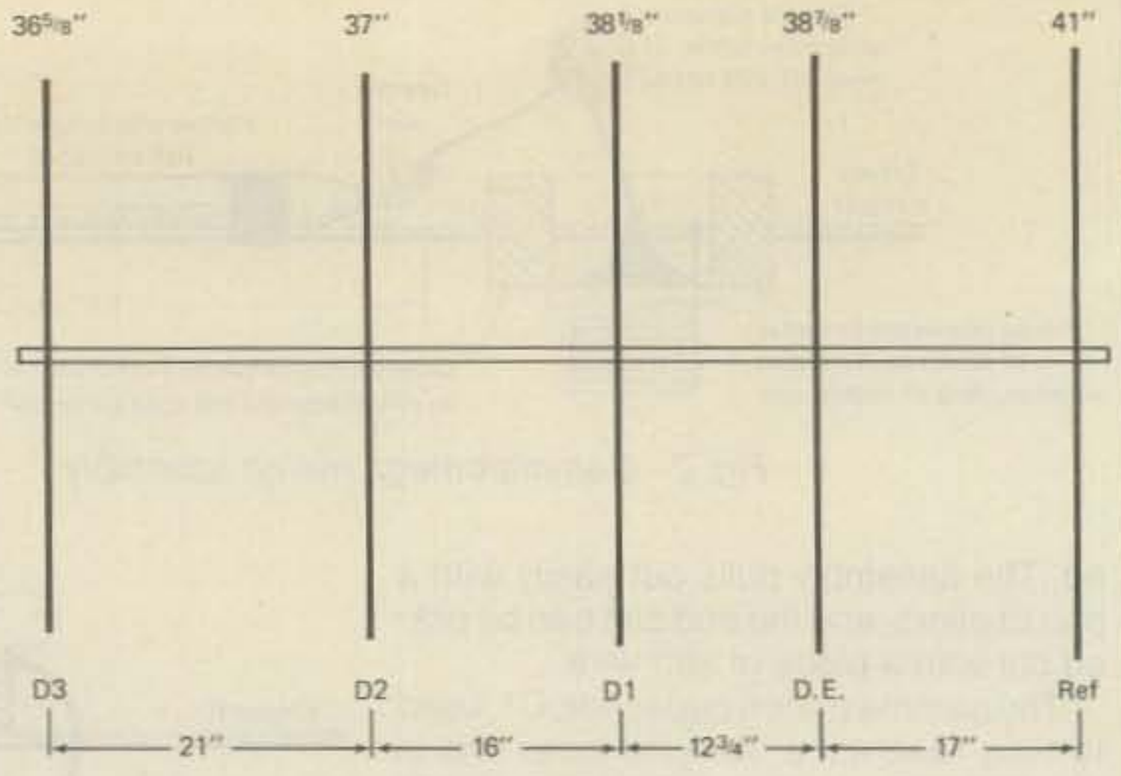


*Fig. 4– Element spacing and lengths. Each beam requires 16 feet of wire for elements.*

## Stacking

Two "5 for 5's" stacked and fed in phase become a "5 for 5" array and give the operator an additional 3 dB of gain. Best practice calls for using exactly identical antennas, including keeping the gamma arms on the same sides and pointing up. Build each Yagi the same way and don't build one as a mirror image of the other. The preferred position for the gamma arm is up. The quarter-wave matching section should also be made of equal lengths of 72 ohm RG59/U to maintain system balance.

The spreader width of 6 feet represents almost a full wavelength and is a good working compromise between gain and directional pattern. Spacing less than ½ wavelength would negate the intent of stacking, and wider than 1 wavelength would yield slightly more forward gain because of a narrower major lobe.

## Tuning

With the transmitter set to low power on your desired *output* frequency, and a v.h.f.-type s.w.r. bridge or reversible through-line-type wattmeter in the line, adjust the gamma strap for lowest s.w.r. This will generally occur about ¼ inch in from the end of the gamma arm.

Experimenting with different values of C1 can also help to fine-tune the antenna. If this is done, also recheck the strap position, as some interaction will occur.

The stacked array is tuned as above, one Yagi at a time. Keep in mind that with either configuration the antenna is tuned to the transmitter output frequency. This will normally be ± 600 kHz of the receiver setting for repeater operation.

## Mounting The Antenna

The small size and light weight of the "5 for 5" lends itself to the use of common TV antenna hardware, masts, and rotators. Naturally, a rotation method is not needed if coverage is required along only one signal path. For example, I use an array fixed toward a fellow ham's station for a simplex RTTY link.

My other "5 for 5" is mounted on a 25-foot mast consisting of two 10-foot lengths of aluminum tubing spliced with a wooden dowel and bolts, and a 5-foot section of a wood pole at the top. A broom stick makes a handy pole, by the way. The mast sits in a container buried at ground level for a foundation, runs by a window where it is hand rotated,[2] and is secured at roof's edge with a slip arrangement.

[2]*Known in some circles as the "Armstrong Method."*


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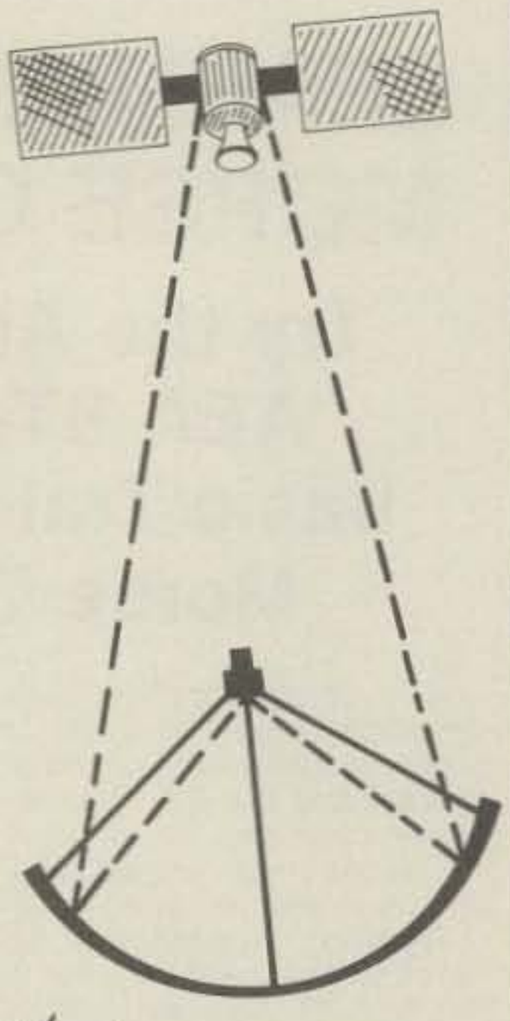

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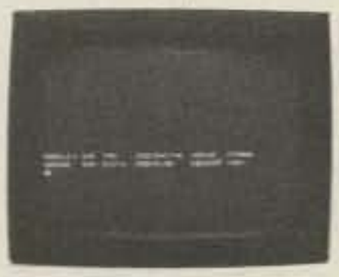
Seven large 256 character memories are backed up with battery power so there is no need to reload information with each use. Memories may also be partitioned providing up to 29 separate storage locations. A type-ahead buffer of 3120 characters makes it easy to compose your response while still receiving. Operator controlled scrolling permits review of up to 10,720 previously received characters. Line length is selectable at 40 or 80 characters, your choice, and all mode and speed indicators are displayed on the screen for instant status recognition. The 9000E has 3 tone groups and 3 shifts which are all keyboard selected.



You won't buy any other communications terminal once you have studied all the advanced operating convenience built into the **Drake Theta 9000E**. It's complete.

DRAKE Theta 550

The **Drake Theta 550** is a compact receive-only communications terminal and is designed to demodulate and display the three most popular over-the-air modes of data communications: CW (Morse Code), RTTY (Baudot), and ASCII. Any standard TV monitor can be used.

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CW automatically tracks over a speed range of 5 to 50 words per minute and RTTY modes offer nine selectable standard speeds of transmission. 12 volts DC is required.

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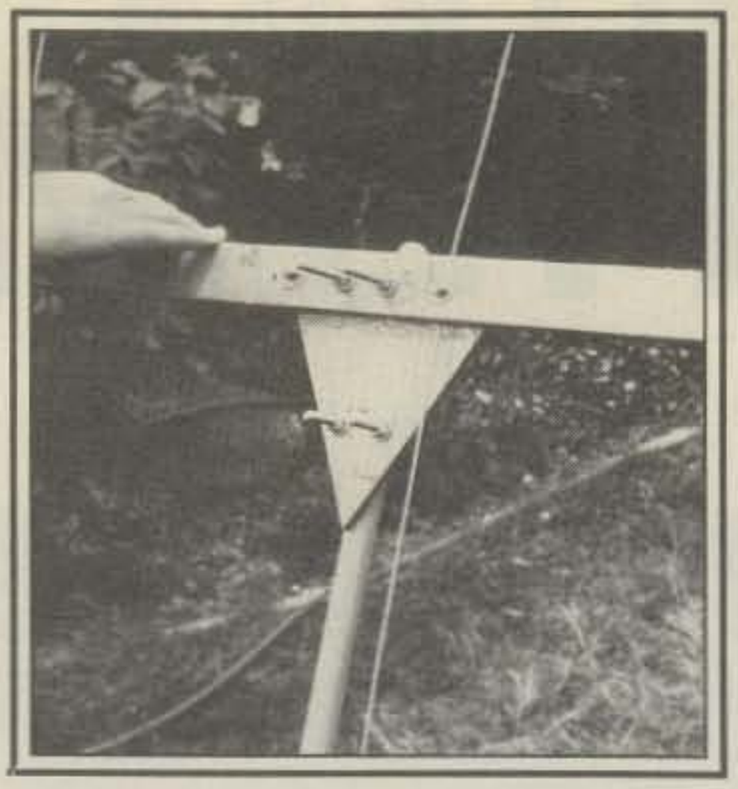
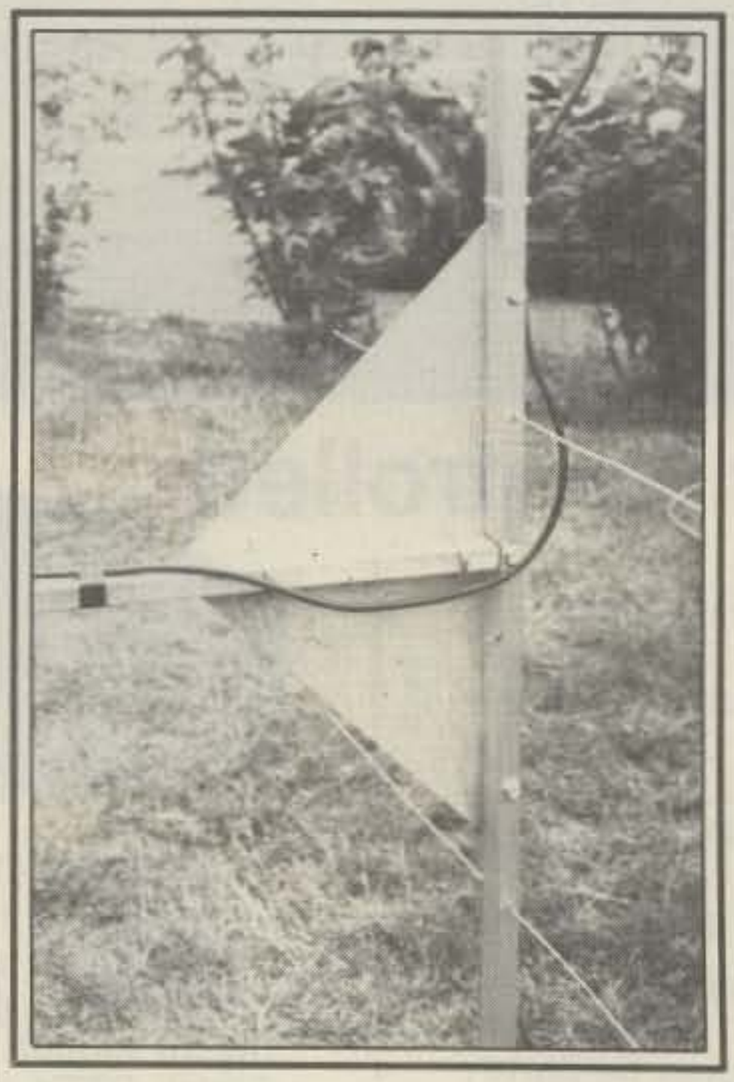


*Close-up detail of mounting for a single "5 for 5." A broom stick is used as the non-metallic mast.*

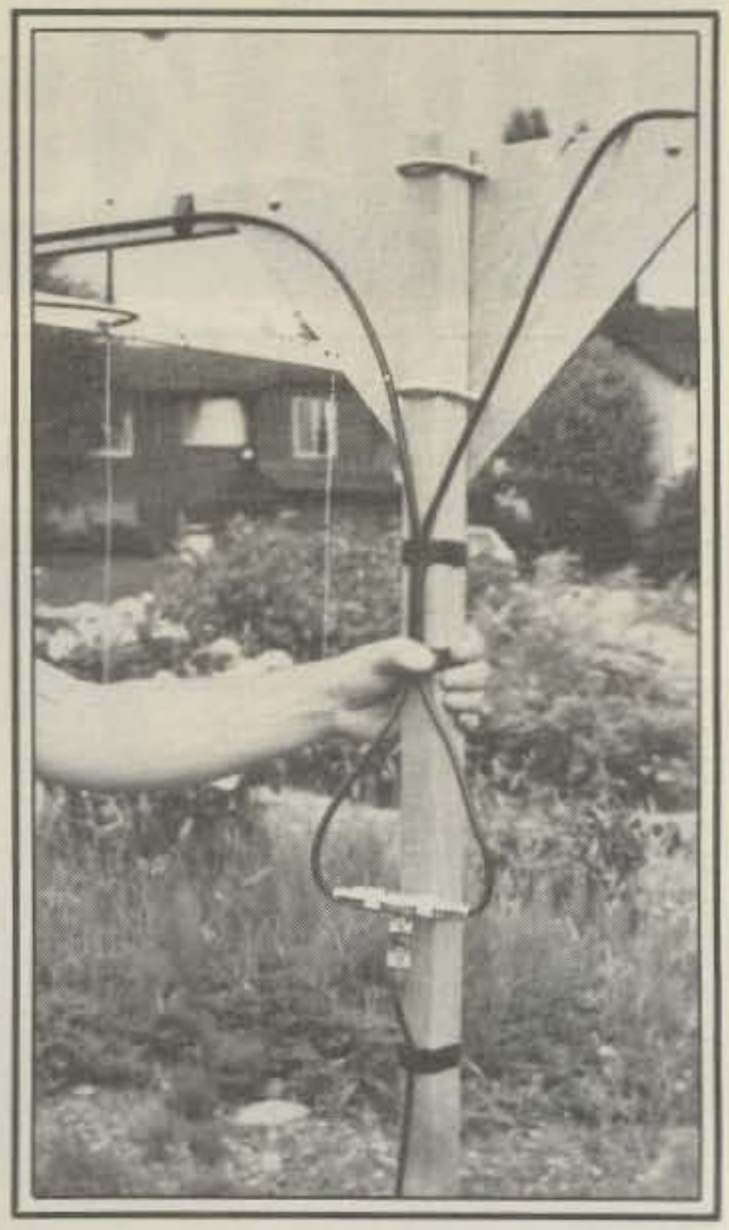


*With the spreader-to-mast gusset, the 1 × ½ inch pieces are butted together. The "U" clamps are chosen to fit the mast. Be sure to allow enough shank length to fit through the assembly.*

**Note:** Because of the close proximity of the mast to the elements with a vertically polarized Yagi, it is desirable to use wood or other nonconducting material for the last few feet of mast.

## A Word About Coax

Although we all know it in theory, we sometimes don't relate feedline losses to actual practice, and use of bargain or surplus coax can eat up much of the advantage of a gain array. If the cable appears brittle or stiff, it can be a sign that the dielectric has aged and will quickly gather moisture or other contaminents. An inadequate or thin shield can also lead to excessive losses at v.h.f. frequencies.



*Close-up detail for the spreader-to-mast assembly of the "5 for 5" stacked array. The mast and spreader are on opposite sides of the gusset plate to allow other antennas to be placed on the mast if desired. The phasing harness fittings should be weatherproofed and taped securely to mast and array.*

For a short run out a window and up the mast, 50 ohm RG 58/U is acceptable for low power. For longer lengths RG 8/U is recommended. If the additional rigidity of the thicker RG 8/U is a problem, terminate the line with a short length of the more flexible RG 58/U.

As a rule, 3 dB of feedline loss will halve your effective radiated power and reduce receiver sensitivity by approximately one half an "S" unit.

## Conclusion

The project has been a success on several fronts, and building the dozen units on our informal production line was interesting and educational to all of us who were involved. Part of that probably was the concept of making a useful piece of new equipment for little cash outlay. It works. Ground-wave contacts heretofore impossible are done with good quieting, and previously unattainable repeaters are now usable.


In addition to John, N7AHX, whose time and effort made the project possible, I would like to thank Roger, KA7MSI, for his photography and Jerry, N7DRR, who did the experimenting with horizontally polarized s.s.b. at the low end of 2 meters. Howard, W7GFU, laid out the diagrams.

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| 205BAS 5el 20m | $295.00 |
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| 153BAS 3el 15m | $74.00 |
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Note: Part numbers with S on the end denote stainless steel hardware. Some small quantities remain of older stock; call for prices.

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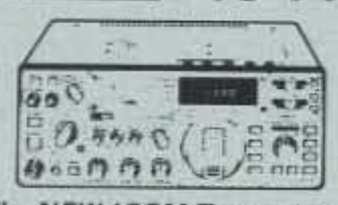

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| 15m845 5el 15m beam | 140lb. | 14.0 |
| 20m436 4el 20m beam | 108lb. | 12.0 |
| This is a custom antenna. | | |
| 20m536 5el 20m beam | 113lb. | 13.5 |
| 20m546 5el 20m beam | n/a | n/a |
| This is a custom antenna. | | |
| 20m646 6el 20m beam | 176lb. | 17.0 |
| 40m329 3el 40m beam | 110lb. | 12.6 |
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**The HAL CWR6850 brings a new dimension to amateur RTTY operation - PORTABILITY! Even though the size is small, the features are many:**

### CWR6850:

● Built-in display screen and demodulators ● 5″ green CRT display ● 32 character display lines ● 4 pages of display ● 6 user-programmable HERE IS messages ● Internal RTTY demodulator for both "high" and "low" RTTY tones, three shifts each (170-425-850) ● Baudot or ASCII baud rates of 45 to 300 baud ● Morse code send and receive 3 to 40 wpm ● Parallel ASCII printer output for received text ● Separate, small keyboard ● Tape input/output connections ● Requires 12 VDC, 1.8 Amperes ● 12.75″ × 11.75″ × 5″ (CWR6850); 13.75″ × 2″ × 7.25″ (Keyboard) ● 20 lbs, including keyboard

## LOW COST AND COMPACT!

**The DS2050KSR is a time-proven RTTY terminal, combining the best of the popular HAL DS2000 and ST5000. Some of the DS2050 features are:**

### DS2050KSR:

● One cabinet for keyboard, display generator, and demodulator ● Full 72 character line by 24 line screen ● 2 programmable HERE IS messages ● Built-in RTTY demodulator for two shifts (170 or 850 Hz) ● Send and receive Baudot RTTY at 45 to 100 baud and ASCII RTTY at 110 to 300 baud ● Send CW at 5 to 100 wpm ● Receive CW (with MR2000 option) from 5 to 100 wpm ● RTTY CW ID is built-in ● KOS (Keyboard operated switch) ● Full current loop interface for send and receive RTTY loop (external loop supply required) ● SYNC idle ● USOS ● WORD mode ● Bright-dim video to distinguish TX and RX text ● 120/240V, 50/60 Hz AC ● 14.1″ × 8.8″ × 4.7″ ● 18 lbs ● Two-tone tan cabinet ● External TV monitor required (HAL KG12 or ESM914 recommended).

CIRCLE 10 ON READER SERVICE CARD

# CATIONS CORP.
# EQUIPMENT

## COMMUNICATIONS TERMINAL

**The CT2100 and KB2100 make up a very versatile and convenient RTTY and CW communications terminal. The CT2100 offers capabilities available in no other single-unit RTTY system. Some of these features are:**

### CT2100 & KB2100:

● KSR or split-screen operation ● Large or small character video ● 72 or 36 character display lines ● 24 lines per display page ● 2 pages of 72 character per line display or 4 pages of 36 character lines ● 12 line split screen transmit pretype buffer ● 2 user-programmable HERE IS messages ● Very large brag tape storage in MSG2100 (2K characters) ● 4 Built-in RTTY demodulators ● "High" tone RTTY (170-425-850 shift) ● "Low" tone RTTY (170-425-850 shift) ● 103 Modem RTTY (1070-1270 Hz; to 300 baud) ● 202 Modem RTTY (1200-2200 Hz; to 1200 baud) ● Baudot, ASCII, or Morse code ● 45 to 1200 baud Baudot or ASCII RTTY ● 5-100 WPM CW ● Crystal controlled synthesized transmit tones match receive filters ● RS232, Loop, or audio I/O interface ● Tape in/out connections ● KOS (keyboard operated switch) for auto TX/RX ● HDX or FDX ● Transmit data from loop device (paper tape distributor, etc.) ● Small separate keyboard with flexible cord for comfortable lap operation ● On-screen status line and tuning indicator ● Serial ASCII printer output to print all received text ● 120/240V, 50/60 Hz AC ● 16.75″ × 3.625″ × 10.375″; 19 lbs (CT2100) ● 14″ × 2.375″ × 7″; 7 lbs (KB2100) ● Two-tone gray cabinet with color front panel graphics ● External monitor required - HAL KG-12 or ESM914 recommended.

### RS2100 - NEW RTTY TUNING SCOPE:

● Matches CT2100 cabinet ● Gives crossed-ellipse type of RTTY tuning indication for CT2100 ● Also includes built-in 175 VDC, 60 ma current loop supply ● Connects directly to CT2100 rear panel ● Also may be used with these other HAL products: DS2050, DS2000, ST5000, CWR685, CWR6850, CWR670, CWR6700, and ST5 or ST6 (with modification) ● One inch green phosphor CRT ● Front panel positon, focus, and intensity controls ● 120/240V, 50/60 Hz AC ● 3.5″ × 8.25″ × 10.156″ ● 12 lbs.

### MSG2100 - Message Storage ROM Option:

● Installs in CT2100 ● Stores 7 - 256 character and 1 - 192 character "brag-tape" or reply messages ● Also stores contents of both HERE IS messages ● Non-volatile storage is not lost when power is turned off ● Type 2716 EPROM programmed by HAL or by anyone with EPROM programmer ● Have several made - one for home, one for field day, etc. ● Coding forms included with each CT2100 - KB2100 system.

## SWL - RTTY and CW, TOO!

**Now you can also enjoy shortwave listening to RTTY and Morse code transmissions with a unit designed for that purpose. The CWR6700 offers many advance features, previously available only in more expensive transmit-receive terminals. Some of these features are:**

### CWR6700:

● Receive ASCII, Baudot, or Morse code transmissions and see the decoded characters on the TV monitor screen ● RTTY speeds from 45 to 300 baud (60, 66, 75, 100, and 300 wpm) ● CW speeds from 4 to 50 wpm ● Unshift on space (UOS) for Baudot reception ● Parallel ASCII printer output ● Printer prints received ASCII, Baudot, or Morse signals ● Requires external TV monitor (HAL KG12 or ESM914 recommended) ● Runs on 12 VDC, 0.8 Ampere ● 8″ × 2.85″ × 12.6″ ● 8 lbs

## RTTY DEMODULATORS:

**HAL has long been a leader in the RTTY demodulator market. Our first two demodulator products, the ST5K and ST6K, are still in use all over the world and are still available on special order from HAL Communications (kit form only). The ST6000, as mentioned above, is a "standard of comparison" for performance and reliability. The ST5000 is a simplified version of the ST6000, particularly suited for limited budget installations where high performance is still a requirement. Some of the ST5000 features are:**

### ST5000:

● Two shifts - 170 and 850 Hz (others available on custom order) ● Internal 175 VDC, 60 ma current loop supply ● Motor control autostart with motor relay and outlet ● Built-in AFSK transmit tone generator with narrow-shift CW ID ● Meter tuning indicator with provision for external tuning scope (RS2100 recommended) ● 2.75″ × 8″ × 12″ ● 9 lbs shipping ● Two-tone blue and beige cabinet.

## HAL COMMUNICATIONS, YOUR RTTY COMPANY:

**HAL Communications Corp.**
**P.O. Box 365**
**Urbana, Illinois 61801**
**(217) 367-7373**

**Since 1969, we have been designing and selling RTTY equipment for amateur and commercial use. We can claim many firsts in this business, including the first amateur video display of RTTY (RVD1001 and RVD1002) and the first commercial electronic amateur Baudot keyboard (DKB2010). The HAL people are proud of the equipment they sell and have a lot of experience in interfacing many types of equipment for RTTY and CW. Yes, RTTY can be confusing, but we'll be glad to help you if you give us a call.**

***They used to say that the man who built a better mousetrap would secure a place in history, but it looks as if W1ICP and KA5NJY just might get there first.***

# Sweeping Out The Trash!

## Eliminating RFI From The Radio Shack TRS-80®, Model I

BY LEW McCOY*, AND FRED TREASURE**, KA5NJY

There isn't much doubt that the most popular computer in use by amateurs is the TRS-80, Model I. Newer models have come along, but the popularity of the Model I remains high as evidenced by the resale value of the units. Our systems consist of Model I, level II with dual disk drives and MX-80 printers. All of our writing and correspondence is done on the computers and printer using the popular word processer *Scripsit*. However, there is one area in which the TRS-80 is a real dog. It is by far the worst radio frequency interference (RFI) generator we have ever encountered—and that includes spark transmitters! How bad is the TRS-80? If it is within 100 feet of a TV set, it will cause TVI on all channels, 2 through 13. In fact, the computer causes interference on the 220 MHz band! Broadcast receivers are practically useless when operated close to the computer. Supposedly, one of the main reasons why Radio Shack completely dropped the Model I from their computer line was the interference problem. Of course, the unit wouldn't meet present FCC radiation standards.

*Here is the cabinet with the top lid removed. The a.c. line filters are near the transformer, but they have since been moved to where the a.c. enters the enclosure.*

## Why the Trash?

To understand the reasons for the Model I causing such horrible interference, one must have some knowledge of digital circuitry. In digital circuits as we use them today, all of the complex pulses generated and fed over data lines are square waves. Additionally, in a computer such as the Model I, the actual square-wave signals have an amplitude of nearly 5 volts; yes, that's 5 million microvolts, which would be a strong signal by anyone's standard. If an S-9 signal is only 100 microvolts, think how strong 5,000,000 microvolts would be! A square wave, by its very nature (it is composed of harmonics), will generate strong harmonics which are radiated from the computer and picked up by nearby TV sets and, of course, your amateur receiver. The fundamental signals of the Model I are used up through 10 MHz (all the way from 60 cycles on up!). You can quickly see that here is a monumental interference problem, particularly if you wish to use the computer for the many amateur applications that are available—and there are many.

## Where It's At

Considerable testing was done to establish just how the interfering signals left the computer. I was told by other amateurs that some of the interference left via the a.c. lines directly from the computer. However, it appears from our tests that the interference is radiated from the case and the interconnecting cables. The radiated signals are picked up by the a.c. lines and reradiated. While we didn't test without using a.c. power on the computer, it is a good bet that the radiated signal would be the same. (Incidentally, we tested the Model III, and it is fairly clean of creating interference—not perfect, but clean.)

The Model I was also tested alongside a 2 meter receiver, and with the computer on the squelch was useless. If the coaxial-fed antenna was removed from the 2 meter rig, you couldn't detect when the computer was on or off, indicating that all the interference was being picked by the 2 meter antenna and none via the a.c. lines. We talked to many other amateurs who had tackled the RFI situation, but none seemed to have made more than a dent in the problem. It was apparent that a more stringent approach than just a few gimmicks here and there was needed.

## Go For It

When an amateur transmitter radiated harmonics in the old days of severe TVI,

*200 Idaho St., Silver City, NM 88061
**Rosedale Rd., Silver City, NM 88061



Say You Saw It In CQ

*All we can say about this is that it is good reading material!*

the answer was to contain all radiation within the transmitter cabinet via tight r.f. shielding and then to use line filtering. This same approach appeared to be the logical method of cleaning up the TRS-80. However, let us make one thing clear now. The steps we went through in the unit described here didn't do the whole job but they did reduce interference to a point where weak signal copy was possible. There was no more TVI or BCI (broadcast interference) even with a TV or BC set alongside the computer. However, on some amateur frequencies you can hear a weak burst of data from the computer.

As you can see from the photos, we transferred the computer into an aluminum housing. Line filtering and cable shielding completed the job. The reader may shudder at the thought of taking his computer apart, but it is not that hairy a job. As a side note, we were fortunate enough to be around when the local El Paso computer store had a bunch of low-cost, surplus Model I boards, so we bought a supply of them. This, of course, got us into trouble-shooting boards and removed the fear of digging into anything as complicated as a full-blown computer. In fact, the computer shown here was completely made up of faulty—but repaired—surplus boards. Take our word for it: any amateur of reasonable intelligence can dig into the computer without any unreasonable fear.

In this case, we mounted the computer board, keyboard, and interface board into the aluminum case. Also, the interface cable connections had an annoying habit of going sour, so we soldered the cable leads between the computer and interface board.

Before going into details of construction, a few more points are worth mentioning. We got on the TRS-80 net which meets each Sunday just above 14,300 MHz and queried the various members as to just what each had done about the interference problem. We would like to take this opportunity to thank WA6BHR, W9LFO, WB3FSR, and particularly, Jose, N1ACA, for their advice and help. The use of conductive paint (supposed to be available from a company called DC Electronics) was mentioned. The idea here is to paint the plastic cases housing the computer/keyboard and interface. Jose had used screening and shielding inside his cases with good results. However, if you contemplate shielding your existing plastic cases, a great deal of caution should be observed in placing the shielding so that it doesn't short out components. Also, we heard that 3M makes a copper sheath-on-adhesive which should be good if you want to go with the existing case shielding route.

## Aluminum Case Details

The photos show the style of the aluminum case we made to shield our TRS-80's. Ordinary sheet stock aluminum or thin sheet metal can be used. The Reynolds Do-It-Yourself aluminum is heavy enough if you brace the cabinet with angle stock. In order to house the computer, keyboard, and interface (plus home-made power supply), the case measures 18 by 18 inches. Fig. 1 shows all the sizes of the parts for the cabinet. In the normal TRS-80 configuration the video display sits atop the interface or directly behind the computer if an interface


# FLEXI-BILITY

AEA once again breaks new ground in the code communications field with the new model MBA-RC reader/-code converter. The MBA-RC decodes Morse, Baudot or ASCII signals off the air and displays them on a large 32 character alphanumeric vacuum fluorscent display. In addition, it will output Morse code for keying your transmitter. It will also generate RTTY (Baudot or ASCII AFSK two tone output. (170 or 850 Hz shifts.) Any of the acceptable input codes can be converted to any of the specified output codes (any speed to any speed). If you have any of the common Baudot RTTY terminals as an example, you can now send and receive Morse and ASCII with your keyboard and printer. You can even generate ASCII or BAUDOT RTTY using your Morse hand key or memory keyer.

Get the details. Write for our free product catalogue or better yet, see your favorite dealer.

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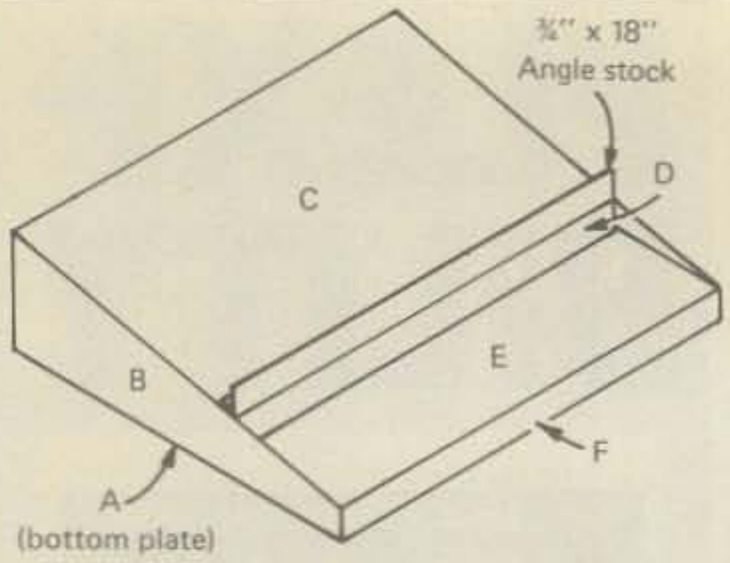
CIRCLE 77 ON READER SERVICE CARD




LEGEND:

| | |
|---|---|
| A = 18" x 18" | D = 1¾" x 18" |
| B = 1" x 7½" x 18" | E = 6½" x 18" |
| C = 11½" x 18" | F = 1" x 18" |

*Fig.1– This drawing provides the important dimensions for the shielded cabinet.*

is not used. In our setup, which we feel is a real improvement, the video display sits behind the aluminum enclosure. On the case, we installed a small right-angle bracket directly behind the keyboard. This serves to hold printed matter, which greatly helps when typing copy into the computer.

In our first cabinet attempt, we installed the keyboard on a level plane, but we quickly found that this created typing fatigue and was awkward. The slight slope to the keyboard helps. In cutting out the keyboard opening we used a power jig saw, and this was the toughest part of the project. Since the photos were taken, the cabinet has been spray painted with gray acrylic paint. Note the control panel just behind the keyboard. Power and reset switches were installed on this panel. The reset switch is simply a single-pole push-button switch in parallel with the existing reset switch on the computer.

One-half-inch diameter PVC tubing was cut up and used for mounting insulators for the computer and interface boards. The line filtering was accomplished by installing 1.2 mH choke (Radio Shack) bypassed with 0.01 uF disk capacitors in each leg of the a.c. where it comes into the cabinet. One could use a T200-size ferrite or powdered iron core and wind the a.c. line onto the form to make a filter. This technique is described in most handbooks.

If you have the TRS-80 power supplies, which is likely, then they must be mounted in the enclosure, and the a.c. lines opened and filters installed. There is room in the enclosures for the supplies.

## Peripherals

Most of us TRS-80 users use other devices attached to the computer, such as TTY terminals, printers, disk drives, etc. Of course, all of these require cables between the computer and the attachments.

All of your shielding will be for naught if you don't properly shield the cables. We used heavy-duty aluminum foil, being careful to ground the cable at both ends, the computer, and the peripheral. We also obtained a roll of very thin copper sheathing which we tried. Don't ask who makes the copper sheathing, because ours was surplus. In any case, while easier to work with, it was no better than the heavy-duty foil. Be sure to ground both ends of the foil for effective shielding. We didn't mention it earlier, but the leads for the video display and tape drive should also be shielded.

You'll probably spot a muffin fan in the photos. The fan is necessary to provide adequate cooling of the computer and interface. In fact, even if you are using the plastic cases, it is a good idea to use small muffin fans to cool the equipment. The Model III uses shielding and some internal computer lead filtering with ferrite beads. We didn't try the ferrite bead technique simply because it involved lifting some IC's to get at their leads.

In conclusion, we would like to hear from other computer users who have tried different techniques on this popular unit. We would be happy to update this information. One thing for sure, our wives no longer complain about TVI and BCI when we are using our computers.

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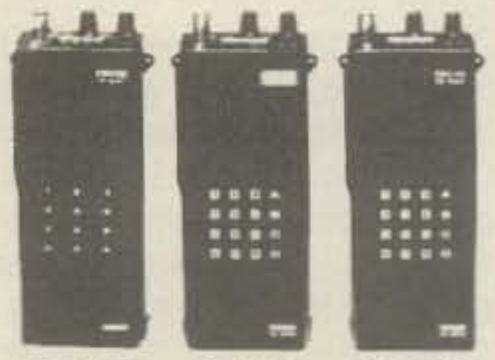


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### FOR CABLE TV

The SWD-1 Video Converter is utilized on cable TV systems to remove the KHz's signal from a distorted video (channel 3 in/out) and also pass thru the normal undistorted/detected audio signal. Rocker switch selects operating mode to remove KHz's distortion from the video or pass all other channels normally. Simple to assemble—less than 30 minutes. Pre-tuned. Input/output Channel 3. Impedance 75 ohms. 117VAC.

**SWD-1** Video Converter Kit ..... **$69.95**

## VTR ACCESSORIES

### SIMPLE SIMON VIDEO STABILIZER

Simple Simon Video Stabilizer, Model VS-125, eliminates the vertical roll and jitter from "copy guard" video tapes when playing through large screen projectors or on another VTR. Simple to use, just adjust the lock control for a stable picture. Once the control is set, the tape will play all the way through without further adjustments. Includes 12V power supply.

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Excellent in isolation and no loss routing system. Simple Simons VSB-300 Video Switching Box enables you to bring a variety of video components together for easy viewing/dubbing. Also you gain the ability to record one channel while viewing another. Unit includes two F-type quick connector ended cables.

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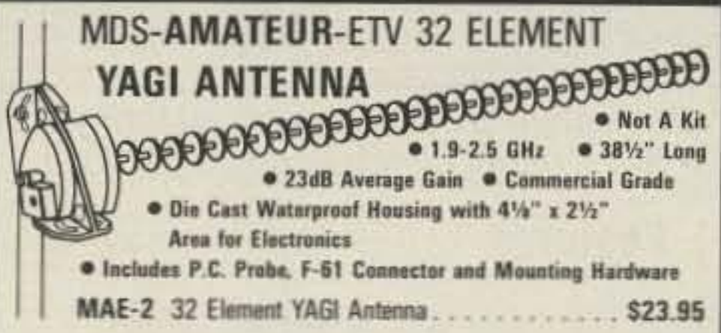
## UHF ANTENNAS and ACCESSORIES

### MDS-AMATEUR-ETV 32 ELEMENT YAGI ANTENNA



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- 1.9-2.5 GHz • 38½" Long
- 23dB Average Gain • Commercial Grade
- Die Cast Waterproof Housing with 4⅛" x 2½" Area for Electronics
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**MAE-2** 32 Element YAGI Antenna ..... **$23.95**

### *Kato Sons'* Down Converter Kit ★1.9 - 2.5GHz★

Designed for Simple Simon by former Japanese CQ Amateur Magazine's UHF Editor/Engineer. Unit utilizes new ingenious Printed Circuit Probe for maximum gain. Circuit board fits inside MAE-2 antenna housing. Requires 1 hour assembly. IC and capacitors pre-soldered.

**Model KSDC-KIT** 1.9 - 2.5GHz Down Converter Kit ..... **$34.95**

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### ZYZZX VHF-UHF Wideband Antenna Amplifier

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These units are not available anywhere else in the world. Each unit will serve many purposes and is available in Kit or Assembled form. Ideal for outdoor or indoor use. I/O impedance is 75 ohms. Amplifiers include separate co-ax feed power supply. Easily assembled in 25 minutes. No coils, capacitors to tune or adjust.

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| ALL-2 Complete kit w/power supply | 34.95 | ALL-2 Wired/Tested w/pwr supply | 44.95 |

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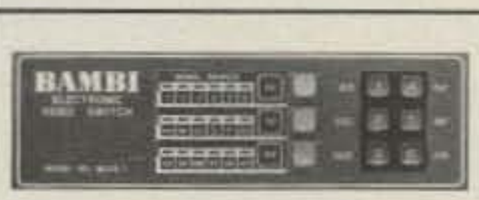
Bambi lets you enjoy using your video equipment the way it should be ... electronically and on line at the push of a button.

**Model BEVS-1** Wired **$129.95**




**Bambi's front panel was designed with the user in mind.** Computer styled construction, with soft-touch keyboard (rated for over 10 million operations), arranged in matrix form allows easy input/output selection without refering to charts. Functions selected through the keyboard are immediately displayed on the 18 LED status indicators.

**Check the quality of Bambi against that of much higher priced competition.** All solid state electronic switching provides low attenuation (3dB), wide frequency response (40-890 MHz), and excellent isolation between signal sources (each I/O section individually sheilded for 65dB min. isolation).

**Bambi's Specifications:**

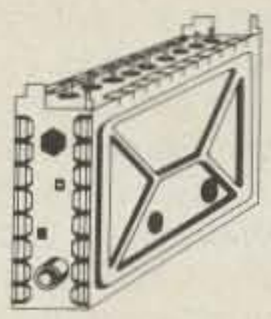
| | |
|---|---|
| Input/Output Impedance | 75 ohm |
| Signal Loss | 3dB ±1dB |
| Noise | 4dB ±1dB |
| Input Return Loss | 12dB min. |
| Isolation | 65dB min. |
| Power Req. | 117VAC 60 Hz, 2W |
| Dimensions | 10¾ W x 6¾ D x 3¾ H |
| Weight | 4½ lbs |

## 7+11 SWD PARTS KITS

### MITSUMI VARACTOR UHF TUNER

Model UES-A56F

**$24.95**



Freq. Range UHF470 - 889MHz
Antenna Input 75 ohms
Channels 14-83 Output Channel 3

| KIT NO | PART NO | DESCRIPTION | PRICE |
|---|---|---|---|
| 1 | VT1-SW | Varactor UHF Tuner, Model UES-A56F | $24.95 |
| 2 | CB1-SW | Printed Circuit Board, Pre-Drilled | 18.95 |
| 3 | TP7-SW | P.C.B. Potentiometers, 1-20K, 1-1K, and 5-10K ohms, 7-pieces | 5.95 |
| 4 | FR35-SW | Resistor Kit, ¼ Watt, 5% Carbon Film, 32-pieces | 4.95 |
| 5 | PT1-SW | Power Transformer, PRI-117VAC, SEC-24VAC, 250ma | 6.95 |
| 6 | PP2-SW | Panel Mount Potentiometers and Knobs, 1-1KBT and 1-5KAT w/Switch | 5.95 |
| 7 | SS14-SW | IC's 7-pcs, Diodes 4-pcs, Regulators 2-pcs Heat Sink 1-piece | 29.95 |
| 8 | CE9-SW | Electrolytic Capacitor Kit, 9-pieces | 5.95 |
| 9 | CC33-SW | Ceramic Disk Capacitor Kit, 50 W.V., 33-pieces | 7.95 |
| 10 | CT-SW | Varible Ceramic Trimmer Capacitor Kit, 5-65pfd, 6-pieces | 5.95 |
| 11 | L4-SW | Coil Kit, 18mhs 2-pieces, .22μhs 1-piece (prewound inductors) and 1 T37-12 Ferrite Torroid Core with 3 ft. of #26 wire | 5.00 |
| 12 | ICS-SW | I.C. Sockets, Tin inlay, 8-pin 5-pieces and 14-pin 2-pieces | 1.95 |
| 13 | SR-SW | Speaker, 4x8" Oval and Prepunched Wood Enclosure | 14.95 |
| 14 | MISC-SW | Misc. Parts Kit Includes Hardware, (6/32, 8/32 Nuts, & Bolts), Hookup Wire, Ant. Terms, DPDT Ant. Switch, Fuse, Fuseholder, etc. | 9.95 |
| When Ordering All Items, (1 thru 14), Total Price | | | 139.95 |

## 7+11 PWD PARTS KITS

### INTRODUCING OUR 7+11 PWD PARTS KITS

NEW

| Kit No | PART NO | DESCRIPTION | PRICE |
|---|---|---|---|
| 1 | 1VT1-PWD | Varactor UHF Tuner, Model UES-A56F | $24.95 |
| 2 | 2CB1-PWD | Printed Circuit Board, Pre-drilled | 18.95 |
| 3 | 3TP11-PWD | PCB Potentiometers 4-20K, 1-.5K, 2-10K, 2-5K, 1-1K, and 1-50k (11 pieces) | 8.95 |
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| 13 | 13SR-PWD | Enclosure with PM Speaker and Pre-drilled Backpanel for mounting PCB and Ant. Terms | 14.95 |
| 14 | 14MISC-PWD | Misc. Parts Kit, Includes Hardware, (6/32, 8/32 Nuts & Bolts), Hookup Wire, Solder, Ant. Terms DPDT Ant. Switch, Fuse, Fuseholder, etc. | 9.95 |
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# CQ Reviews: The Ten-Tec Argosy as a DXpedition Transceiver

BY JOHN J. SCHULTZ*, W4FA

How about organizing your own small "DX"pedition? In this case DX does not necessarily mean an isolated reef beyond civilization, but rather one of the countries in the Caribbean or European areas with which the U.S. Government has concluded reciprocal licensing arrangements or which otherwise issues guest licenses to U.S. amateurs. One can have a great deal of fun on such a DXpedition both with amateur radio and as a tourist without the enormous complexities of organizing a "real" DXpedition. Of course, one normally will not work thousands of stations under such circumstances, but then again, that should not be the objective. The tourist arrangements can be made according to one's pocketbook, and the amateur radio costs (equipment expense and transport) can be held within quite reasonable limits if one properly selects the equipment and accessories to be taken along.

The purpose of this article is twofold: to technically review some Ten-Tec equipment which seemed ideally suited for a "gentleman's" DXpedition, and then to relate a bit of the fun involved in actually using the equipment in a European country typical of one which an amateur might visit. Of course, the technical review information should be useful to any reader regardless of whether he or she is contemplating a DXpedition, just searching for some h.f. equipment suitable for high-performance portable/mobile use on the domestic scene, or perhaps contemplating a purchase for a "starter" station.

First of all, what was so appealing about the Ten-Tec equipment for the intended purpose? Features, size, and cost would have to be the answers. The Argosy transceiver seemed to have all the operating features on s.s.b. and c.w. that one would normally need: full coverage of all h.f. bands that are presently in use around the world; enough power for "barefoot" operation, but without excessive current drain on receive due to a non-digital frequency readout; a selection of filters for both s.s.b. and c.w. modes; RIT and a notch filter; full break-in on c.w.; etc. The size seemed very compact at 4" × 9½" × 12", and with a weight of only 8 lbs., it could easily be fitted in a suitcase or shipped by airmail or air freight, including accessories, at a reasonable cost. The importance placed on the cost factor involves, of course, a very subjective evaluation. It seemed that the Argosy offered a lot of features for the cost involved, yet it wasn't so expensive that insuring it would be a problem or, if the very worst happened, that its loss would be catastrophic.

*The controls and indicators on the front of the Argosy are particularly well dimensioned and spaced for the 4" × 9½" panel dimensions.*

To get down to some specifics, however, Table I lists the details regarding the Argosy's physical and claimed electrical details. They should be read rather carefully, since in comparison to some other manufacturers' specifications, Ten-Tec doesn't hesitate to get down to quite some detail in an effort to provide meaningful data. For instance, the power requirements (at 12–14 v.d.c.) are listed for both the receive and transmit modes. The power input as well as power output specifications are provided for both the high and low power modes of operation. The performance of the standard and optional c.w./s.s.b. filters is carefully described, etc.

Not to keep anyone in suspense, it should be mentioned that the Argosy easily met its technical specifications when test-bench checked, and some specific comments are provided later. But, as is the case for most transceivers, technical specifications only tell part of the story. Most of us probably evaluate and look at a new transceiver, more or less, in the order of apparent external features and conveniences, construction, circuitry details, technical performance, and, finally, on-the-air results. So, we'll try to approach a look at the Argosy in that order.

## Features

The apparent external features of the Argosy, as already mentioned, are very attractive. Any amateur who has been around for the last 10 years or so can't help but compare the Argosy to the old Atlas 180 transceiver. The 180 was a classic as one of the first 100-watt-class solid-state transceivers, but it did have some shortcomings. The Argosy design on the other hand contains all the features that one could desire in an equally small transceiver package. The frequency coverage is complete, the tuning rate is the same on all bands (about 18 kHz per knob revolution), and tuning is always in the same direction (c.w. for increasing frequency).

The switchable power level of 10 or 100 watts input is a very sensible compromise in several respects, especially when one considers battery operation. One-hundred watts input is certainly enough for good contacts, but provides at least double the operating time from a typical rechargeable battery pack as compared to the usual 200 watt input transceiver. The 10 watt input level, which operates at the same efficiency as the 100 watt level, allows for greatly extended portable operating time. QRP enthusiasts might favor it all of the time, while others might find it a great convenience to switch to after a solid contact has been established at the 100 watt input level.

The operating features on the Argosy

*c/o CQ Magazine



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**GENERAL**
**Frequency Coverage:** 3.5–4.0, 7.0–7.5, 10.0–10.5, 14.0–14.5, 21.0–21.5, 28.0–28.5, 28.5–29.0, 29.0–29.5, 29.5–30.0 (V.f.o. provides approximately 40 kHz overrun on each band edge.)
**Operating Modes:** Normal sideband; reverse sideband; c.w.
**V.f.o. Stability:** Less than 20 Hz change per °F averaged over a 40° change from 70° to 110° after a 30 minute warmup. Less than 15 Hz change from 105 to 125 v.a.c. line voltage when using a Ten-Tec power supply.
**Tuning Rate:** Vernier, 18 kHz per revolution, typical.
**Dial Calibration:** ±2 kHz when zeroed to the nearest 25 kHz marker.
**Antenna Impedance:** Low impedance unbalanced (coaxial), 50–75 ohms.
**Power Requirements:** 12–14 v.d.c. regulated to 5% or better. 500 mA receive; 9 A maximum transmit. Power switch remotely controls power supply.
**Semiconductors:** 39 transistors, 4 FET's, 10 IC's, 49 Diodes, 3 PIN Diodes, 2 LED's.
**Construction:** Rigid steel chassis. Molded front panel. Aluminum back, top and bottom. Stainless steel tilt-up bail.
**Dimensions:** HWD 4" × 9½" × 12" (bail not extended)
**Net Weight:** 8 pounds

**RECEIVER**
**Sensitivity:** 0.3 μV for 10 dB S + N/N, typical.
**Selectivity:** 4-pole crystal filter. 2.5 kHz bandwidth, 2.7:1 shape factor @ 6/50 dB.
**Audio Output:** 1 watt at 8 ohms with less than 2% distortion. Built-in compression loaded speaker in bottom.
**I-F Frequency:** 9 MHz
**Notch Filter:** Greater than 50 dB rejection notch, tunable from 200 Hz to 3.5 kHz.
**S-Meter:** Automatically switched on when receiving.
**Spurious Responses:** More than 50 dB down except 28.980 MHz (which can be eliminated by using low end of 29.0–29.5 MHz band segment.)
**I-F Rejection:** 60 dB
**Offset Tuning:** Receiver, ± 3.0 kHz, typical, detent zero position.
**Crystal C.W. Filters:** Optional plug-in accessories. Model 217 has 500 Hz bandwidth; Model 219 has 250 Hz bandwidth.
**Crystal S.S.B. Filter:** Optional plug-in accessory. Model 218 has 1.8 kHz bandwidth.
**8-Pole Crystal I-F Filter:** Optional plug-in accessory Model 220. 2.4 kHz bandwidth. Used in place of standard plug-in 4-pole s.s.b. filter.
**Noise Blanker:** Optional plug-in accessory Model 223. I-f type, 50 dB blanking range.
**Audio C.W. Filter:** Optional plug-in accessory, Model 224. Center frequency 750 Hz. Position One has 450 Hz bandwidth down 10 dB at 400 Hz and 1500 Hz. Position Two has 150 Hz bandwidth, down 40 dB at 400 Hz and 1500 Hz.
**Calibrator:** Optional plug-in accessory, Model 226. 25 kHz crystal type, pulsed tone.

**TRANSMITTER**
**D.C. Power Input:** 100 or 10 watts, switchable. 100% duty cycle for up to 20 minutes, all bands.
**R.F. Power Output:** 40–50 watts in High Power position, 4–5 watts Low position.
**T/R Switching:** PIN Diode antenna switch, Push-to-Talk on s.s.b., full break-in (QSK) on c.w.
**C.W. Sidetone:** Internally generated. Adjustable tone and volume independent of a.f. control. Operates only in c.w. mode.
**S.S.B. Generation:** 9 MHz 4-pole crystal ladder filter. Balanced modulator. Converts to 8 pole with optional Model 220 filter.
**Microphone Input:** High impedance crystal, ceramic or dynamic.
**Carrier Suppression:** 40 dB minimum.
**Sideband Suppression:** 30 dB minimum at 1 kHz tone.
**Spurious Output:** Less than −45 dB.
**Meter:** Indicates forward or reverse peak power on transmit, front-panel switch.
**ALC Control:** High power only. LED indicator.

**FRONT-PANEL CONTROLS**
AF gain/POWER (Pull-off); DRIVE; NOTCH; OFFSET (detent center); BAND Switch; Main tuning knob; MODE switch; NB ON/off; Meter FWD/REV; CAL ON/off; XTAL filter IN/OUT; AF filter IN/OUT; AF filter 1/2; MICrophone jack; PHONES jack.

**REAR PANEL CONTROLS AND CONNECTORS**
**Controls:** HI/LO POWER switch.
**Connectors:** ANTENNA; KEY; POWER input; GND post; SPARE (3); 12 VDC jacks (2 auxiliary).

*Table I– Complete technical specifications for the Argosy.*

completely overshadow those found on the old Atlas 180. Besides RIT (offset tuning) covering about a ±3 kHz range, there is a notch filter tunable from 200 to 3500 Hz. The standard 4-pole crystal filter provides about a 2.5 kHz bandwidth and a 2.7:1 shape factor at 6/50 dB and is adequate for most uses. However, if one adds either of the optional 8-pole s.s.b. filters (1.8 or 2.4 kHz) or the optional crystal ladder c.w. filters (which cascade with any s.s.b. filter installed) or the optional audio c.w. filter, one can have receiver performance which approaches or exceeds that found on most base station equipment depending on which mix of filters is installed. The main point is that the filter options allow one to tailor performance to one's needs. An optional noise blanker is also available for mobile applications. An optional pulsed-type calibrator provides 25 kHz markers, although the transceiver will tune to 10 MHz for WWV reception and to 7.335 MHz for CHU. The full break-in feature on c.w. is nicely complemented by the built-in c.w. sidetone with both variable pitch and volume controls.

The metering/indicator functions are very practically done. The front panel meter serves as the usual "S" meter on receive, and on transmit it can be front-panel switched to serve as a direct measuring r.f. power output meter or s.w.r. meter. The s.w.r. function does *not* require that one adjust any "set" control for full-scale meter deflection and then switch to read s.w.r. An LED serves as an a.l.c. indicator.

As mentioned before, the surface comparison between the new Argosy and the old Atlas 180 was inevitable in the author's mind. For those who like a bit of nostalgia, one can read the author's original review on the 180, which appeared in the May 1975 issue of *CQ*, and the author's modification article on the 180, which described "major" improvements such as adding RIT and c.w. sidetone and which appeared in the February 1976 issue of *CQ*. It would be a discredit to belittle the pioneering efforts of the people who developed the 180, but it's almost hard to believe that the 180 sold for $599 in 1975 and yet provided only a fraction of the features of the Argosy. However, not


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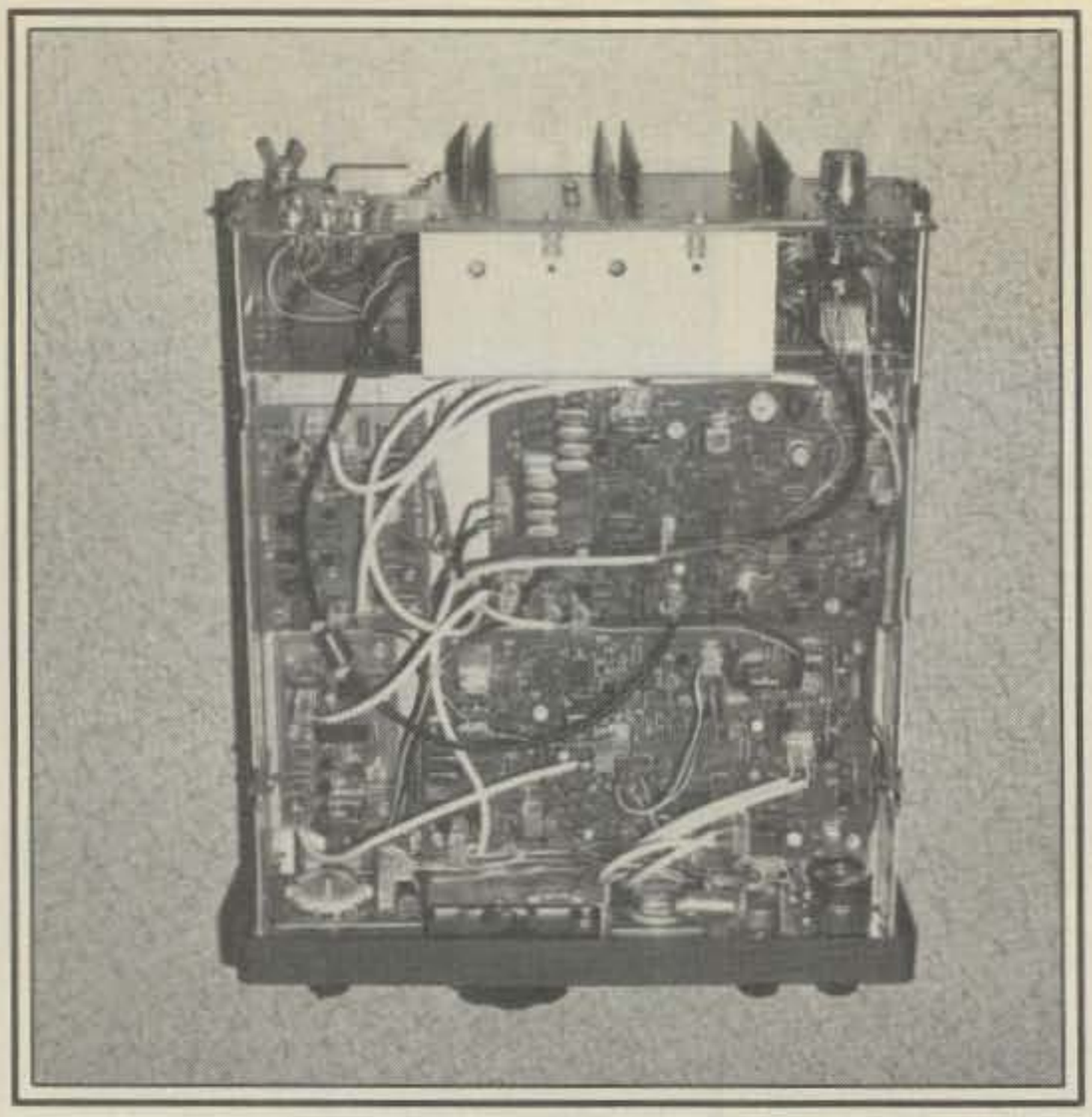
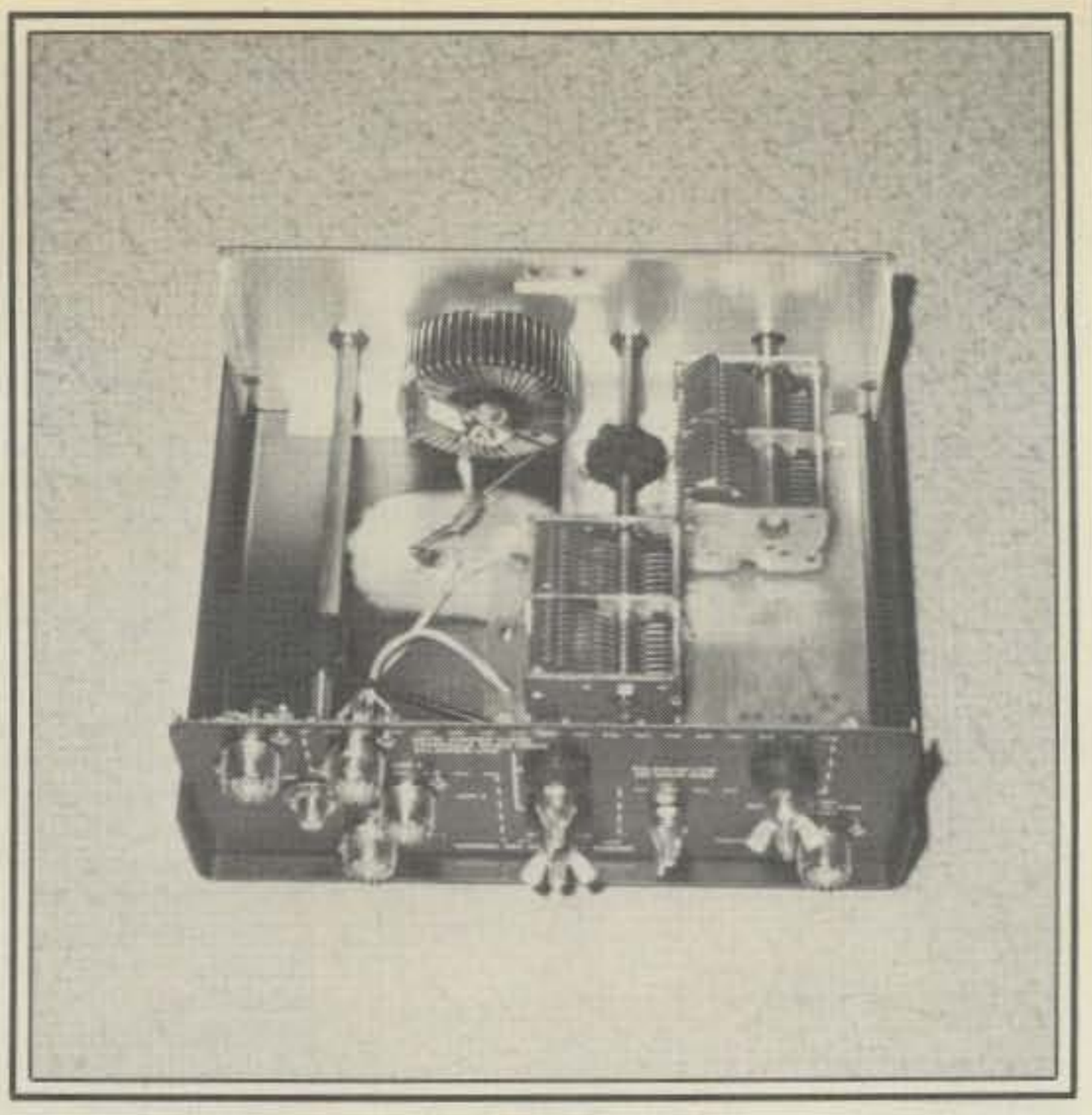


*Taking off the covers on the Argosy, one sees a compact but neat grouping of PC boards on top and on bottom of a middle shelf. The power amplifier compartment is to the rear.*



*The inductor inside the Model 227 Antenna Tuner is an intriguing component with fully 47 coil tap positions.*

to praise Ten-Tec too highly, it should be mentioned that they could only equal the 180 design in one respect. The 180 did not require any receiver front-end or final amplifier adjustments (i.e., it was a completely "no-tune" design). Neither does the Argosy require any adjustments in the receive or transmit modes!

## Construction

The Argosy has a molded aluminum front panel, and the internal metal frame construction basically provides for three general, separately shielded areas where PC boards can be mounted: on the top and bottom of the central shelf and in a rear compartment. Some general details of the construction can be seen from the photograph showing the Argosy with its top cover removed. Rolled metal covers serve to completely enclose the transceiver. These covers are not perforated to provide dust protection, and the whole transceiver gives the impression of good, tight construction.

As usual, Ten-Tec stays away from the idea of using just two or three major PC boards in the interest of better circuit isolation. There are nine major PC boards all of which are fix-mounted. However, connectors are used on all boards for interconnecting (with a few minor exceptions for some r.f. connection points). The v.f.o. assembly is separately shielded, and a rear shield compartment provides for isolation of the r.f. power amplifier circuitry. The PC boards have all their component mounting positions and connector positions carefully labeled. With the exception of a bank of rear-panel phono-type connectors which are rivet mounted and some snap-in connector mounts, all other areas use regular metal hardware mounting. There is an amazingly generous use of lockwashers, etc., that one normally doesn't associate any longer with factory-assembled equipment. All in all, the construction of the Argosy deserves high marks and would seem to augur for very reliable operation under mobile or similar circumstances.

The placement of the front-panel controls is also interestingly done. When one really studies all the controls and switches on the front panel, remembering its 4″ × 9½″ size, it's amazing that there can be so many of them without their getting in the way of each other. One might debate a bit about some of the control placements (e.g., I would have reversed the meter and tuning knob/dial scale placements), but one can't argue with the fact that the controls are well spaced and of uniform size and that there are no subminiature or possibly awkward dual concentric controls.

The tuning knob rotates with a light feel at about 18 kHz/revolution and has a skirt with 0–100 kHz calibrations. Ten-Tec claims a dial readout accuracy of ±2 kHz, but one can get down to ±1 kHz with any degree of care when calibrating against WWV on 10 MHz or against the optional 25 kHz pulsed calibrator. The dial scale above the tuning knob is both simple and effective. The scale marker is a red illuminated one that seems to "float in space" across the dial scale, yet one normally would not think that it is activated by a regular dial string mechanism. This simple mechanism does, of course, save a continuous 1½–2 amperes (!) current drain as compared to an LED frequency readout in a portable transceiver.

The front-panel meter is backlighted and has very clear scale markings. It has the usual "S" meter scale, an s.w.r. scale of 0 (1:1) to 3 (1:3), and a power output scale of 0–50 watts.

The rear panel of the Argosy contains the usual antenna, power ground, and key connections. Additionally, there are several 12 v.d.c. jacks for accessory items and several spare phono-type connectors which can be wired up to control items such as a linear amplifier. The high/low power switch is also located on the rear panel. The reason for its location there appears mainly to be a technical one since it switches r.f. paths around the power amplifier located in the rear compartment of the transceiver.

## Circuit Details

Fig. 1 shows a block diagram of the functional parts of the Argosy. Basically it is a single conversion transceiver covering the complete 80, 40, 30, 20, 15, and 10 meter amateur radio bands (with about a 40 kHz overrun on each band edge) in the c.w. and s.s.b. modes, and it utilizes a 9 MHz i.f. As one can see from the diagram, a d.s.b. signal is first generated in the **SSB GEN** section and then goes to the **RF/MIXER** board where it passes through an s.s.b. crystal filter and then is translated to the final output frequency. The crystal filter used is normally a 4-pole, 2.5 kHz bandwidth type, but it can be replaced by an optional 8-pole, 2.4 kHz bandwidth unit. The s.s.b. signal then passes through a **Band Pass Filter** unit and via some buffer amplifiers to the final amplifier stages. The BPF filter unit consists of some seven individual filters having two poles each (one for each band except



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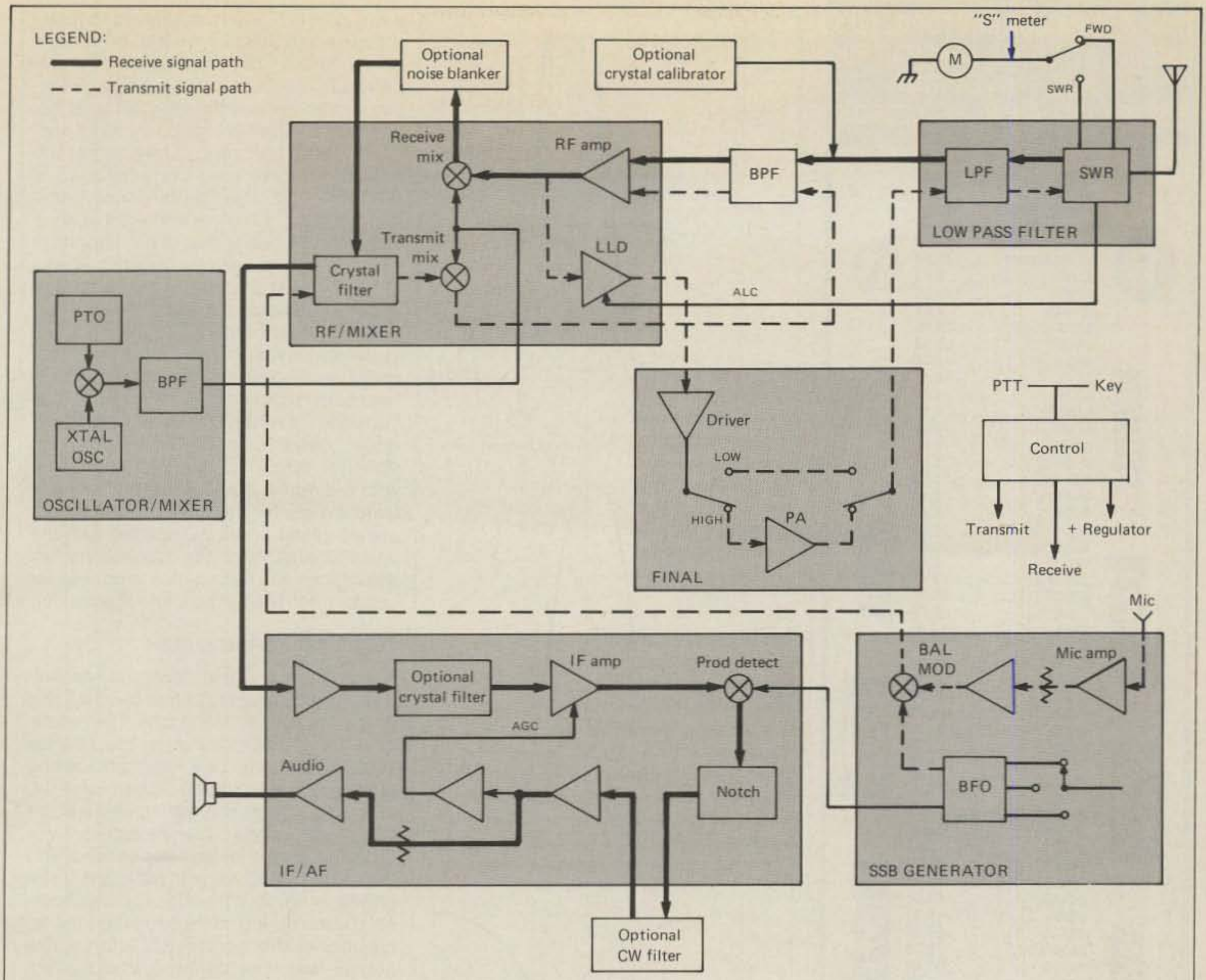


*Fig. 1– Argosy block diagram.*

for two on 10 meters). After final amplification, the output signal passes through a low-pass filter unit and s.w.r. monitoring circuitry.

In the receive mode, the signal path is basically reversed. The incoming signal goes through the low-pass and band-pass filter units and then to a broadband r.f. amplifier stage. It is translated in a balanced mixer to the 9 MHz i.f. and goes through the s.s.b. filter. After this the signal goes to the i.f./a.f. board which contains provisions for various optional filters. First of all, there is a provision for an optional crystal filter which works in cascade with the s.s.b. filter on the **RF/MIXER** board. The optional filters available are a 1.8 kHz bandwidth unit for s.s.b. and 500 Hz or 250 Hz bandwidth units for c.w. After the product detector stage there is a standard notch filter and then a provision for an optional audio-type c.w. filter centered on 750 Hz which has two front-panel selectable bandwidths of 450 Hz and 150 Hz.

There are many interesting circuits in the Argosy, and although they can't all be covered, we'll highlight a few. First, however, one might have noticed that the Argosy has all sorts of selectivity provisions and options. Fig. 2 shows some performance diagrams for the various standard and optional selectivity devices. Which options might be of interest depends on one's operating interests and, of course, pocketbook. In any case, all of the optional filters are of the plug-in type so one can add them at any desired time.

An item of curiosity in any solid-state transceiver these days is the receiver "front-end," especially if it is no-tune and there are no r.f. attenuator provisions as in the Argosy. Fig. 3 shows the basics of the r.f. amplifier stage used. Signals coming from the band-pass filter board pass through a 9 MHz i.f. trap and then on to a 2N5109 used as a broadband amplifier with a bifilar r.f. transformer used in its collector circuitry. The signal then goes on to an MC1496P IC used as a differential double-balanced mixer. The 2N5109 is a medium-gain low-noise transistor developed by RCA for v.h.f. wide-band amplifier usage.

The driver/final amplifier stages used in the Argosy are shown in fig. 4. Q1 and Q2 constitute a class AB linear amplifier of wideband design. In the low power mode of the Argosy, the output of this amplifier is used directly as the transceiver's output, operating at maximum efficiency for its class of operation. In the high power mode, Q1 and Q2 drive Q3 and Q4, which operate as a 100 watt input class AB amplifier. T4 appears to constitute a balanced output, but one side is grounded off of the final amplifier board.

Fig. 5 shows the Low Pass Filter board. Although this board is so named, it contains some much more interesting items than the filters. The Argosy features full break-in on c.w., and because of its power level, the QSK switching is completely solid state. Diodes D1 and D4 switch the antenna from transmit to receive in conjunction with Q1. PIN diodes D3 and D4 connect the antenna to the receive input when receiving and are back biased by a voltage rectified at D1 and D2 when transmitting. The forward power/s.w.r. measurement circuitry is on the same

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| 866A | 20.00 |
| 872A | 25.00 |
| 1616 | 2.75 |
| 5670 | 3.47 |
| 5684 | 32.00 |
| 5687 | 5.37 |
| 5751 | 3.76 |
| 5814A | 3.35 |
| 5879 | 5.75 |
| 5894 | 75.00 |
| 6005 | 5.30 |
| 6146B | 8.20 |
| 6360 | 6.50 |
| 6528A | 95.00 |
| 6550A | 8.20 |
| 6883B | 11.00 |
| 7360 | 11.95 |
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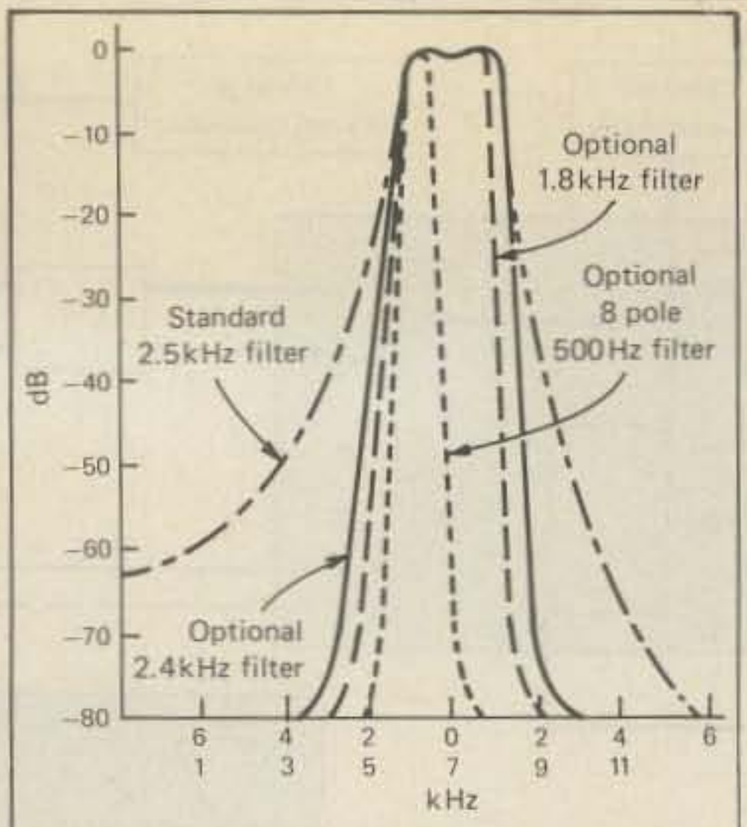
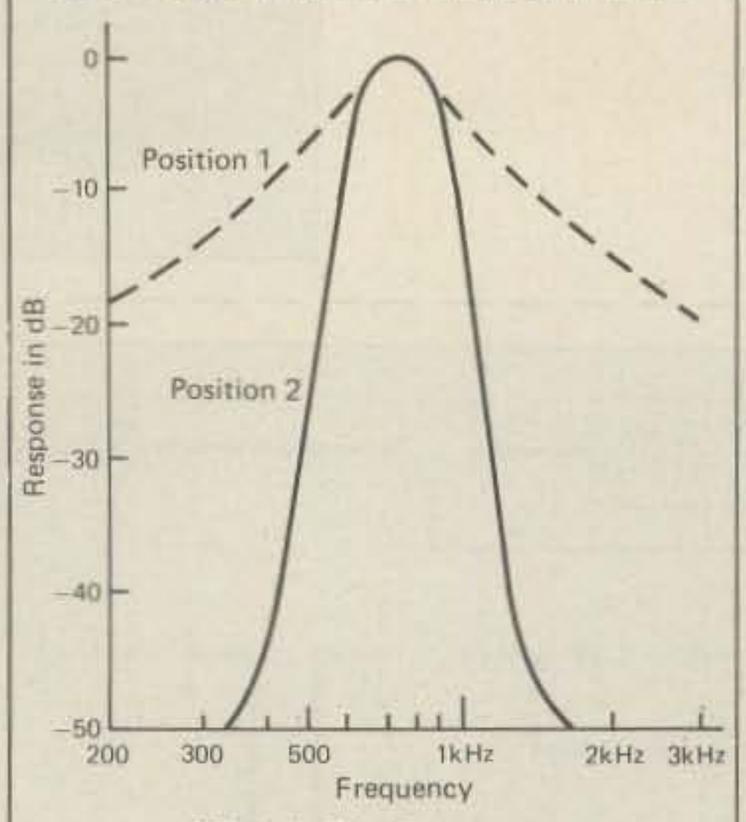
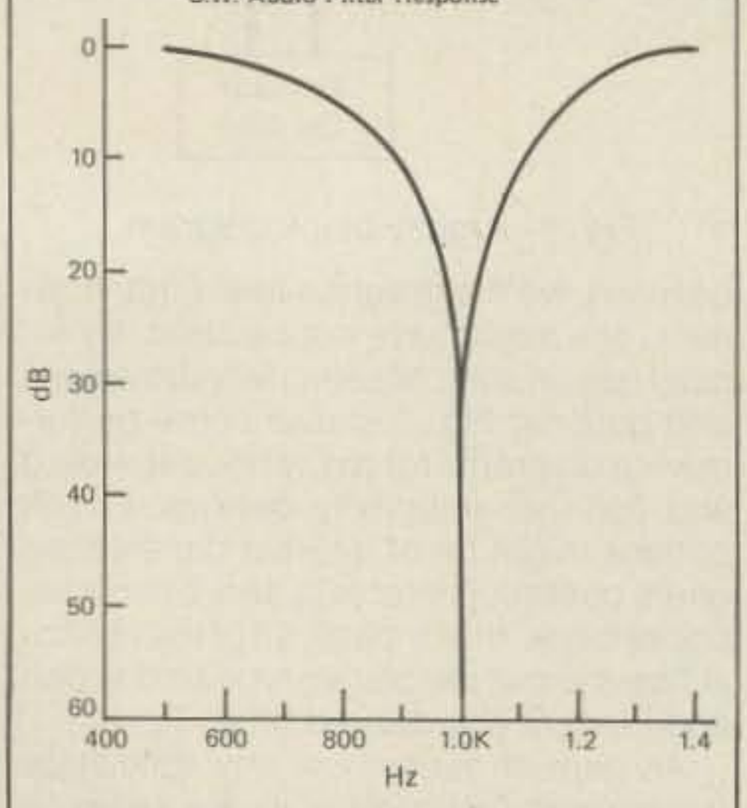



Argosy I-F Response with Standard and Optional Filters




C.W. Audio Filter Response




Notch Filter Performance Adjusted to 1kHz Point

*Fig. 2– For a moderately price transceiver, the Argosy offers an unusually complete mix of standard and optional i.f. and a.f. filters. Responses are shown for the various standard and optional i.f. filters, the optional c.w. a.f. filter, and the standard a.f. notch filter.*

board. The s.w.r. bridge, utilizing T1 as a line coupler, has the sensed reflected power rectified to d.c. by D9 and is used to drive a meter. R3, in series with the meter, is adjusted so the meter reads a 3:1 s.w.r. with a 150 ohm dummy-load resistor and when the a.l.c. output, or forward power output (D8), is such that the front-panel LED lights to indicate full peak output. In this manner the need for a **set** adjustment for the s.w.r. circuitry is not necessary. Theoretically this means that the circuitry will not read correctly s.w.r.'s produced by low termination impedances (e.g., 17 ohms for a 3:1 s.w.r.). However, in reality this is not important since s.w.r. adjustments are always made for what amounts to the sensing of minimum reflected power.

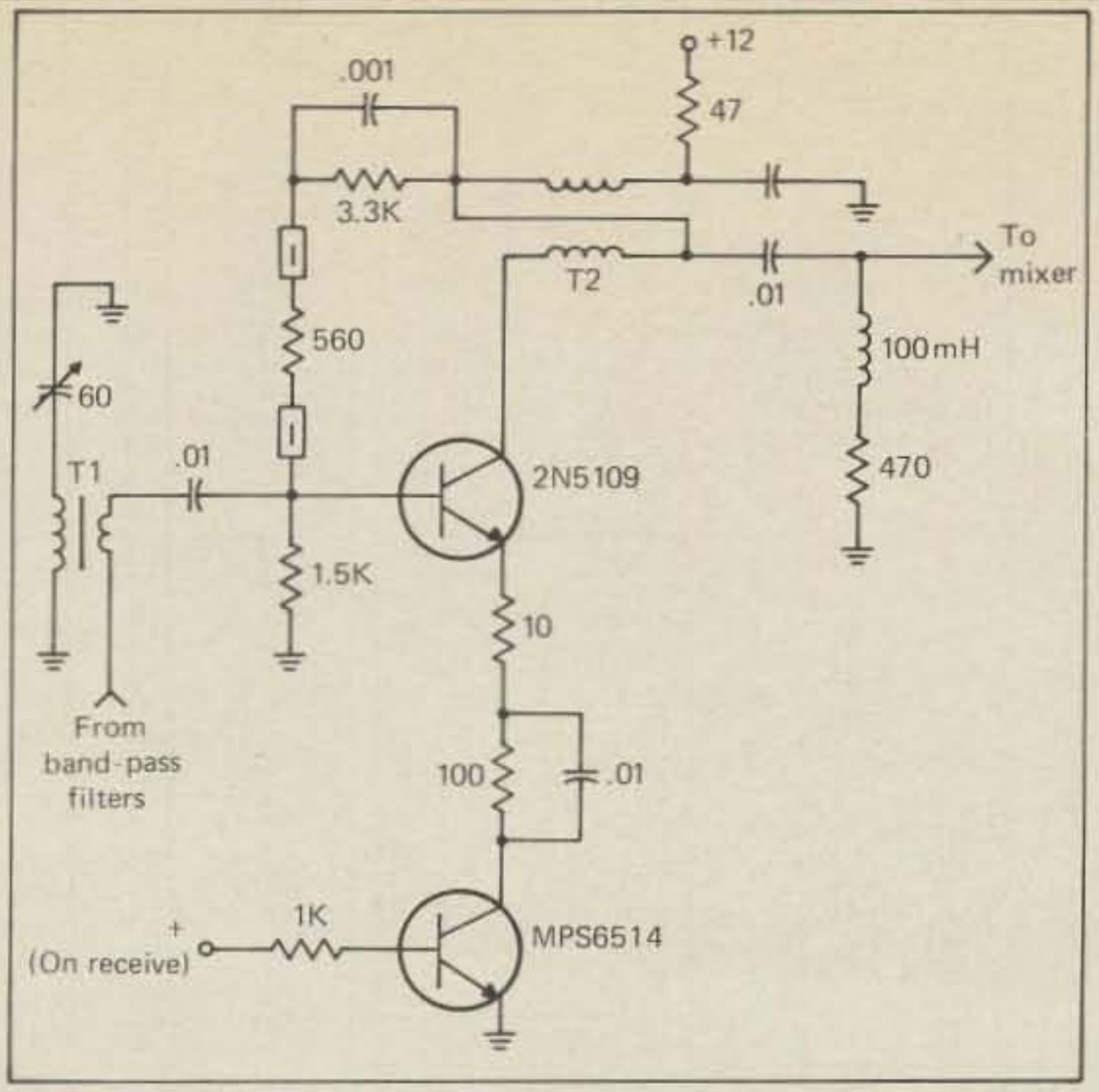
There are a lot more intriguing circuits in the Argosy, such as all the transistor switches associated with the full break-in capability band-edge birdie elimination circuitry, differential double-balanced mixer circuits, etc. The bandswitch switches all the r.f. circuits associated with it directly. Some diode switching is used mainly for the filter options. There are no relays at all associated with the basic operation of the transceiver, although one can be installed to control accessory items such as a linear amplifier.

## Technical Performance

For its price class, the Argosy exhibited some of the best "bench checks" this writer has seen in a long time. The receiver sensitivity was well within the 0.3 V for 10 dB STN/N ratio on all frequencies and often was much better than that value. I.f. and image rejection varied around the 50–60 dB range. The selectivity was checked using various filter options, and the values found were all within those depicted in fig. 2. V.f.o. stability was rock-solid even during some bang-it-on-the-table checks after I got tired of listening to a steady test tone during a stability run. There is, however, some hand capacitance effect as one touches the tuning knob (readily acknowledged by Ten-Tec in their Argosy manual due to a floating v.f.o. tuning shaft design as a trade-off for improved stability). Ten-Tec notes that this effect is *only* apparent if one reaches beyond the plastic tuning knob and touches the metal 0–100 kHz calibrated skirt. This is true, but I doubt that anyone will ever notice it in normal operation.

The receiver portion of the Argosy is remarkably free of spurious responses. Ten-Tec acknowledges one at 28,980 kHz (less than S1) which can be bypassed by using the overrun below the 29,0–29,5 MHz band segment. I found extremely weak ones also at 4.005, 21.000, and 21.320 MHz. But, commenting on them is meant as a definite compliment rather than a criticism. The receive circuitry of the Argosy is remarkably "quiet" and sensitive. All in all, the specifications listed in Table I are truly representative of Argosy receive-mode performance.

In the transmit mode, performance was equally creditable. Carrier and sideband suppression exceeded 40 dB. Third-order IMD products on s.s.b. were quite




| Freq. (MHz) | A | B | A | B | A | B |
|---|---|---|---|---|---|---|
| **19.5** | 5 | 4.5 | 10 | 25 | 50 | 42 |
| **28.5** | 5 | 4.5 | 10 | 25 | 50 | 45 |
| **21** | 5 | 4.5 | 10 | 25 | 50 | 47 |
| **14** | 5 | 4.3 | 10 | 25 | 50 | 47 |
| **10** | 5 | 4.3 | 10 | 25 | 50 | 47 |
| **7** | 5 | 4.5 | 10 | 25 | 50 | 50 |
| **3.5** | 5 | 4.5 | 10 | 25 | 50 | 50 |

A = Measured output power into dummy load.
B = Argosy meter reading.

*Table II– Power measurements.*

*Fig. 3– The broadband r.f. amplifier stage in the Argosy receive chain. T1 is a 9 MHz i.f. trap, and T2 is a broadband bifilar r.f. transformer wound on a small ferrite core. The MPS 6514 acts as a switch to turn the r.f. amplifier stage "on" during receive.*

better than average (about −40 dB), although somewhat better than average results should be expected in a 100 watt amplifier *vis-a-vis* a 200 watt amplifier. The harmonic suppression was quite notable, ranging from −50 to −70 dB on second harmonic measurements. At the power level of the Argosy, this should mean that in most practical situations no external low-pass filter should be required. Power output measurements on the Argosy, as tabulated in Table II, produced some interesting results. The built-in forward power wattmeter in the Argosy proved to be quite accurate in both the low- and high-power measured extremes. For a meter indication of 5 watts output on the various bands, the actual power output varied over the extremely tight range of 4.3 to 4.5 watts. For an indicated 50 watts output, the actual power output ranged from 42 to 50 watts. But, for an individual output power of 25 watts, the actual output power consistently measured 10 watts, indicating some sort of meter scale printing error. Ten-Tec has probably taken care of this in later production runs, since their current brochures correctly indicate a 10 watt meter scale marking in place of what used to be the 25 watt meter scale marking.

## Home QTH On-the-Air Results

The Argosy is a particularly easy transceiver to operate. Tune-up consists of placing the pushbutton for **Forward/Reverse** meter reading in the **Reverse** (s.w.r.) position, the Mode position in the **Lock** position, and then increasing the **Drive** control while adjusting an antenna tuner for minimum s.w.r. until finally the **Drive** control is advanced far enough such that the **a.l.c. LED** lights to indicate maximum power output. If one wants to tailor the output level for a particular QRP value, the preceding procedure has to be modified a bit in that the forward power scale on the meter has to be used to set the desired power level. But, in any case, tune-up is straightforward.

The main tuning knob has a light feel to it such that one can easily spend a great deal of time searching around, for instance, a 50 to 100 kHz band segment for DX without becoming tired of tuning. The pushbutton controls are interesting in that one can depress them partially to hear the effect of operation (e.g., switching-in a different i.f.filter), but one has to give them a small final depression before they permanently engage.

C.w. operation is superb because of the completely quiet full break-in operation. As Ten-Tec mentions in some of its literature, one really can have a conversation on c.w. rather than sending the usual monologue. However, there are many other practical advantages involved. Chasing DX is simplified because one can almost instantly hear if a DX station comes back to another station, and one can often catch a station using semi- or full break-in during pauses in a CQ transmission. The sidetone monitor in the Argosy is adjustable as far as volume and pitch are concerned, and the controls can be accessed via screwdriver slots on the right side of the cabinet. It is not difficult to extend these controls via plastic shafts if one has the desire to adjust them fairly frequently.

S.s.b. operation produced various

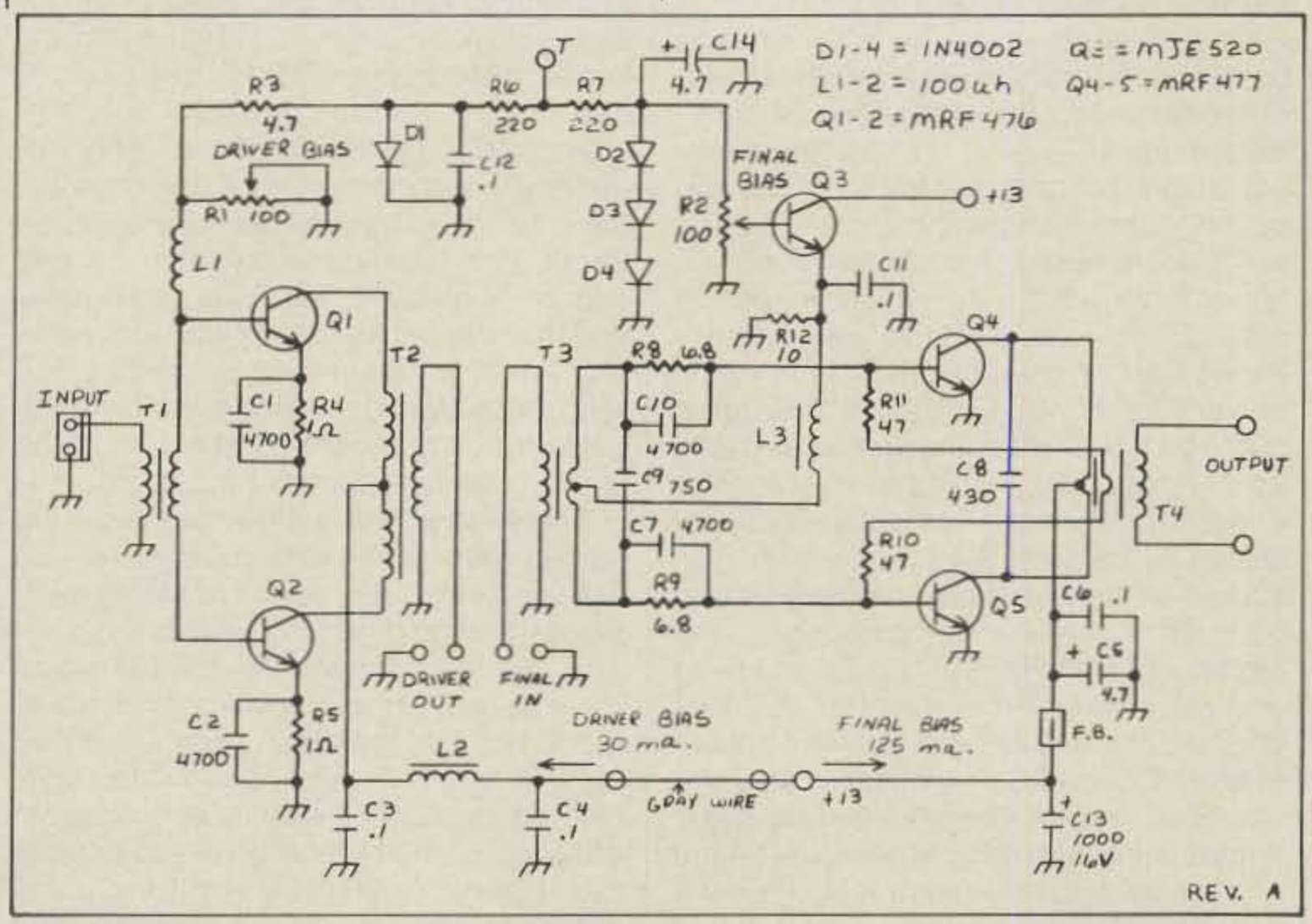



*Fig. 4– The driver and final amplifier stages in the Argosy. Note how for low-power operation, the output of the driver stage is used alone and routed (by switching external to the amplifier board) to the low-pass filter assembly.*

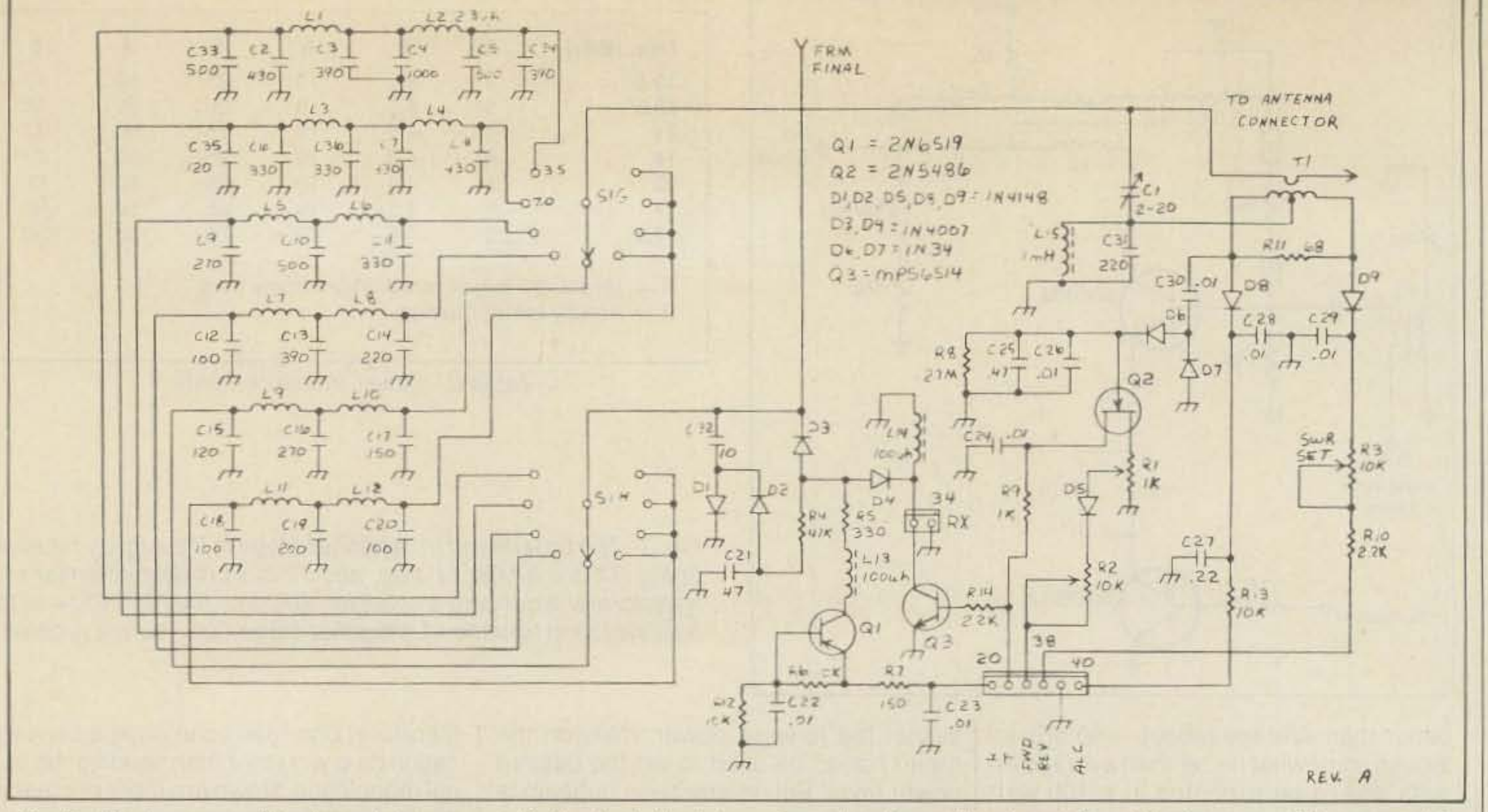



*Fig. 5– The low-pass filter board. As covered in the text, the interesting circuitry on this board is not the low-pass filter assembly, but the full QSK circuitry which uses non-relay switching and the s.w.r. measurement circuitry.*

pleasant surprises. The Argosy was used barefoot with Ten-Tec's Model 215 ceramic-type microphone, which has a shaped response to somewhat emphasize "presence" frequencies. The first call was on 20 meters to 4N4NF who was calling CQ and running about 57. He came back with a 59 + 20 dB report. Then after that QSO a PA1 portable called, etc. Many other QSO's confirmed that the Argosy is as good an s.s.b. transceiver as a c.w. transceiver. Audio reports were consistently good.

On the receive side, the Argosy has to be evaluated from several perspectives. There is no doubt that the receive capability is sensitive and that the combination of the standard 4-pole s.s.b. filter and built-in notch filter plus the offset tuning will accommodate most operating requirements. But, in which direction should one venture if one wants to enhance the basic capabilities of the transceiver? As mentioned before, this turns out to be a pocketbook question as much as anything else. For s.s.b. operation in general, I'd certainly vote for the optional Model 220 8-pole, 2.4 kHz crystal filter, since it is effective in both the receive and transmit chains. For c.w. enthusiasts, the Model 217 500 Hz crystal filter is an excellent choice; I find that the 250 kHz crystal filter idea is too sharp. The optional Model 224 Audio c.w. filter is sort of a "sleeper" if one doesn't want to invest immediately in a more expensive i.f.-type crystal filter. Even though it is labeled a c.w. filter, its wide position (450 Hz) is quite useful for QRM reduction on s.s.b. (see fig. 2), while its narrow position (150 Hz) is excellent for c.w. use.

The optional Model 223 Noise Blanker could not be fully tested. It appeared to be quite effective against spike-type ignition noise and certainly merits attention for mobile installations. Its effectiveness against the "woodpecker" varied quite a bit, being effective at times and ineffective at other times as the "woodpecker" changed its pulse duration.

The Ten-Tec optional Model 226 Crystal Calibrator provides 25 kHz markers. It is a pulsed-type marker and is very easy to identify. Whether one needs it or not depends upon one's operating habits. The Argosy tunes to 10 MHz, and one can calibrate its frequency dial at that frequency according to WWV or another frequency standard station. If one does so, the true *lower* band edge calibration on the other h.f. bands falls within ± 1 kHz and is quite good. However, the *upper* end true frequency calibration on the other h.f. bands can vary quite a bit (± 3–4 kHz). Considering the modest price of the calibrator, I'd recommend it just to be sure of one's frequency calibration.

The Argosy has a small but excellent built-in speaker. An external speaker can provide more direct sound reinforcement since it can be directed towards the operator, but tests showed such an arrangement to provide only a minimal improvement. The clarity of the Argosy's audio on receive is remarkable. Side-by-side tests with several other small-size transceivers showed that the Argosy produced a far "cleaner" audio except if the transmitting station was using a fair amount of speech pre-emphasis. Then there was no noticeable difference. Admittedly, this is a subjective evaluation, but it is a hard impression to discount after numerous A/B tests with other transceivers.

## Manual

Besides a complete manual, the Agosy does come with a small packet of wrenches and tuning tools plus an accessory power-supply plug in case one operates the unit from a d.c. source other than the Ten-Tec 225 a.c. power supply. This plug is the only uncommon plug used on the Argosy. All other plugs used are commonly available types, such as phono types and ¼-inch headphone types.

The owner's manual is extremely complete. It starts out with installation instructions for fixed and mobile station use, then goes on to the use of the various controls, and finally on to complete alignment and service information. There are complete diagrams for each PC board, generous use of photographs, voltage charts for each IC or transistor, and a detailed parts list. Any experienced amateur with reasonably good test equipment should be able to service the Argosy in case of difficulty or at least get close enough to the problem such that a PC board exchange only may be required. There is basically a one-year warranty on the Argosy, which includes the output transistors. Although no problems arose with the Argosy unit tested, some minor problems did take place with Ten-Tec gear used earlier. The response of the service department in those cases has to be rated as outstanding. Prompt acknowledgement was received that the gear had been received for repair, the repaired gear was returned promptly in new, clean packing, and there was no



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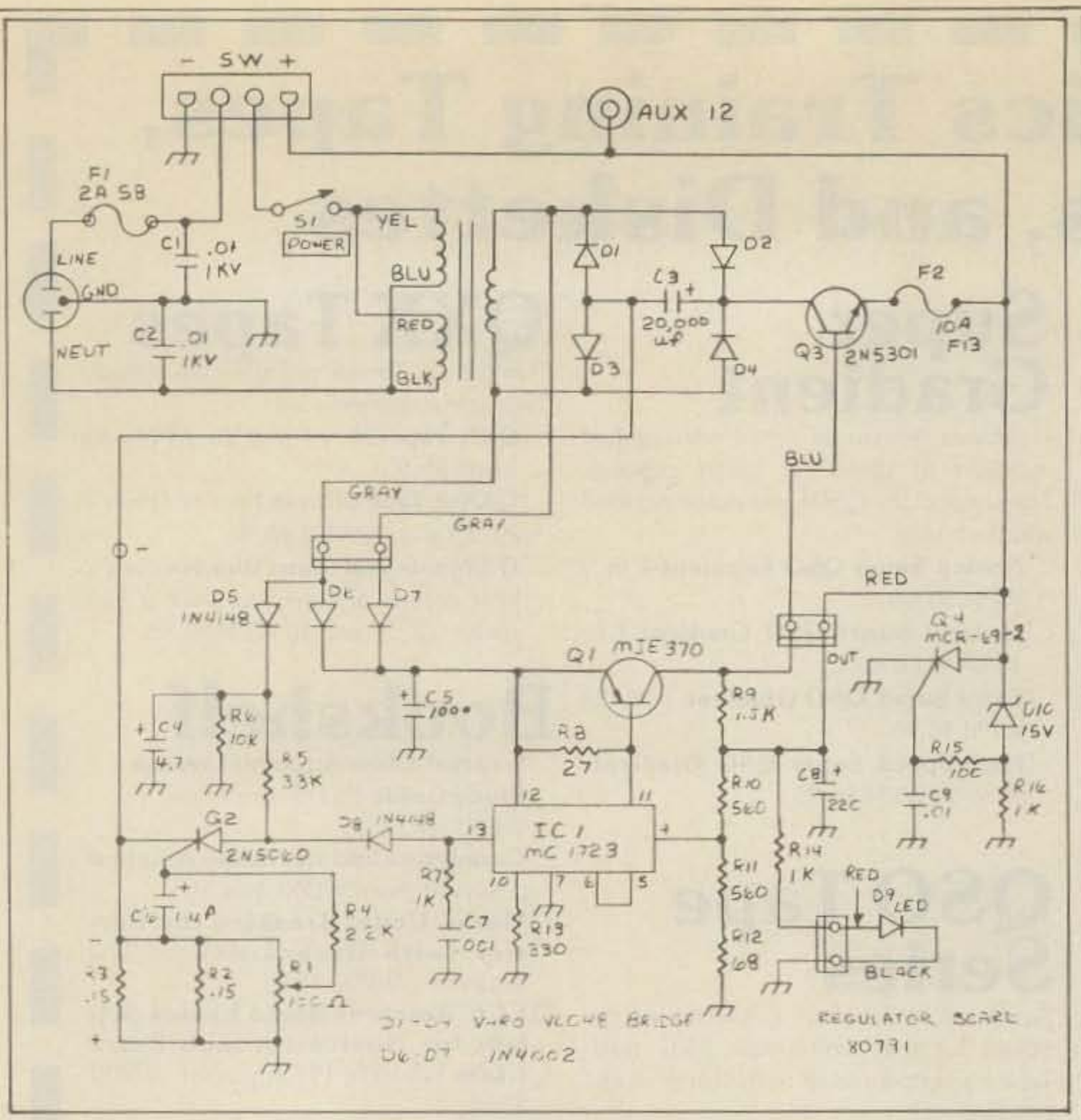


*Fig. 6– The circuitry of the 225 power supply shows that it is more than a simple unit with full output regulation circuitry, overcurrent, and "crowbar" protective circuitry.*

quibbling about whether the gear was exactly in warranty or not.

## Outboard Accessory Items

Ten-Tec has an extremely complete line of accessories that fit with the Argosy. They can't all be covered in detail, but I'll try to highlight at least a few items.

The Model 225 Power Supply is a nice compact unit (3½" × 4" × 10½") that operates on 105–125 or 210–250 v.a.c. input and supplies a regulated 13.5 v.d.c. output at a nominal 9 amperes. The circuit diagram of the unit is shown in fig. 6. It utilizes a series regulator circuit with a 2N5301 as a pass element and a 723 IC as a regulator. It incorporates over-current shutdown and over-voltage protection if something should go wrong with the power supply. The circuit breaker used has electronic latching with a trip point at 10 amperes. I'd rate the power supply as a prime accessory to be considered for use with the Argosy. One could construct or find other power supplies to work with the Argosy, but the regulation (1% from no load to full load) and the complete protective circuitry in the 225 would seem hard to beat.

If one should use a different power source, including a battery-type one, Ten-Tec highly urges the use of their Model 1125 circuit breaker in the d.c. line to the transceiver. It is a fast-acting 10 ampere breaker that provides optimum protection for the final transistors. The breaker was installed in the d.c. power pack prepared for portable use of the Argosy and it will be described in a future article.

The Model 227 Antenna Tuner will actually handle output power of 100 watts continuous (200 watts peak) and is a bit overrated for the Argosy. However, it fits nicely with the Argosy and has a number of convenience features, such as provisions to select up to three unbalanced (coax-fed) antenna outputs, a single-wire output, a balanced-line output (via a built-in balun), and a tuner bypass mode. The basic circuitry of the tuner uses the now familiar T-network with two 260 pF capacitors. The most intriguing aspect of the tuner, however, is the inductor used. As specified, it has 47 (!) taps and is made of 18-gauge silver-plated wire on a 2-inch diameter core. Not having encountered much more that a 20-odd position switch in my experience, I wondered what trick was used to achieve a coil switch with 47 taps. In fact, no trick was used, but rather a clever idea was formed. The photograph of the 227 with the top cover removed shows the inductor. It appears to be wound on a 2-inch diameter core with equally spaced windings. The rotator contact has a notch cut in it so it "indents" as it slips over and makes contact with each turn. The overall result is an inductor which can be adjusted almost as finely as a roller inductor, but which is much more compact and probably without some stray capacitance effects associated with roller inductors.

Finally, one should mention Ten-Tec's 215P ceramic microphone. It has a somewhat rising 200–4000 Hz response, being basically omnidirectional but slightly directional at the higher frequencies. I found that it worked extremely well with the Argosy and also with Ten-Tec's Model 234 RF Speech Processor, which was covered in a previous review.

## Summary

As of this writing, the Argosy hasn't gone on its mini-DXpedition yet. However, it certainly has been interesting to test and use the Argosy in a fixed station installation. One thing is clear: the Argosy offers a great amount of unique features (both on and behind the front panel) in relation to its price class.

*This little Ten-Tec "package" illustrates a number of outboard accessories available for the Argosy. To the left is the Model 215 Ceramic Microphone, on top the Model 227 Antenna Tuner, and to the right the Model 225 Dual Primary Power Supply and Model 670 Single Paddle Electronic Keyer.*



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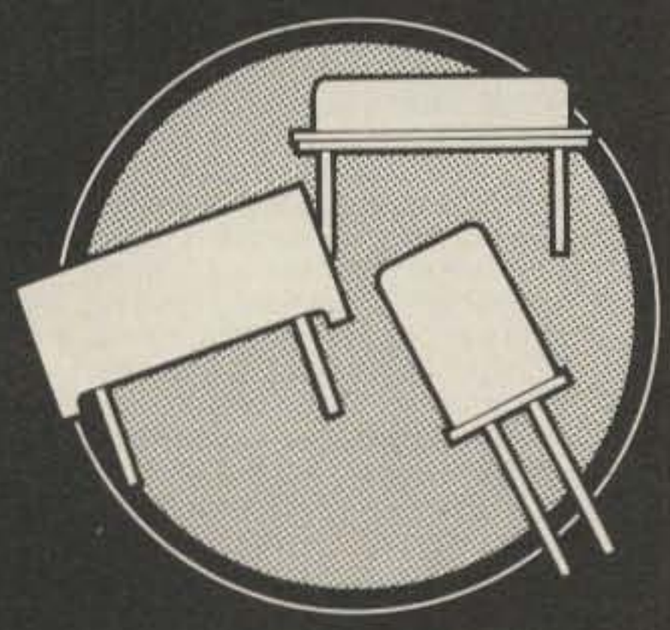

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***This project comes just in time for our 160 Meter Contest next month. There's still time to put one together and join in the fun.***

# A T Match For 160 Meters

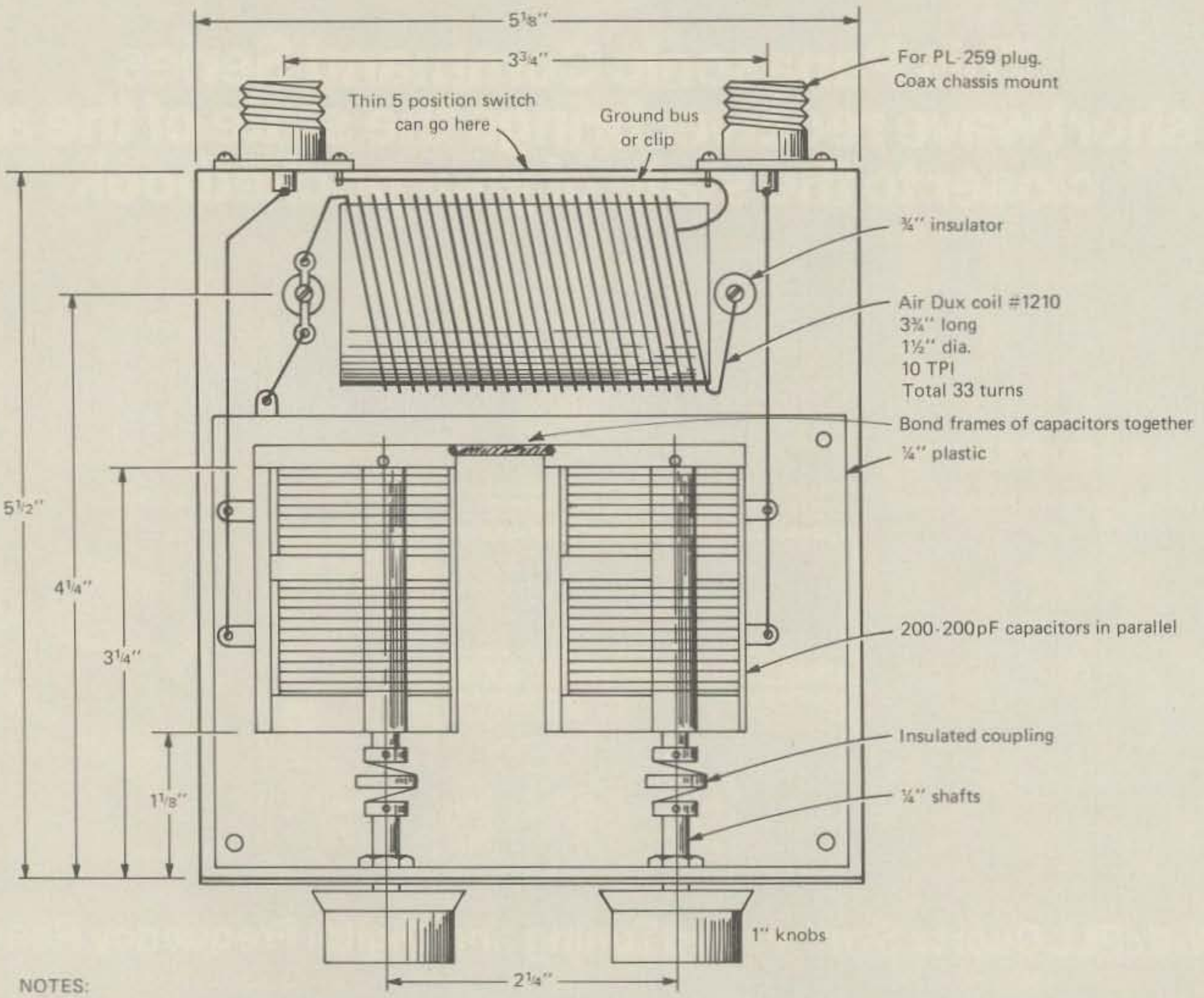
BY ED MARRINER*, W6XM

My new transceiver uses 6146's in the final with a pi-network output. It would not feed into a 52 ohm load on 160 meters. Both capacitors were fully meshed! I reasoned that if the transceiver were fed into 75 ohms, the loading capacitor would decrease, and the plate tuning, which is effected, might also decrease enough to tune.

Large value capacitors for 160 meters are hard to find, but you can easily parallel single-section ones. Thus, I decided to try a T Match described by M. Walter Maxwell, W2DU, in a series of articles in *QST*.[1] This would match my 75 ohms to 52 ohms which I use to feed the base of a base-loaded vertical at 52 ohms.

The T Match was built and the idea worked. I gained enough capacity so I could tune at 1800 kHz, and the final always looked into zero s.w.r. The T Match might also be a good idea for the transistor finals which decrease power output as the s.w.r. goes up. I might add, if you are thinking of not using a matching device and just hanging extra capacitors on the output of the transmitter, forget it. Most of the sets now have a filter trap installed to cut out certain signals into the receiver, and it will upset this filter and/or other output circuits.

*528 Colima St., La Jolla, CA 92037




NOTES:

1. Matcher was built into a Radio Shack Archer Deluxe metal utility cabinet. 5¼" wide x 3" high and 5⅞" deep. (13.3 x 7.6 x 14.9 cm.) Catalog #270-253. I was able to find a miniature six (6) position switch and fit it at the top and back of the cabinet. It would be advisable to use a deeper cabinet for more room if you are not mechanically adept.
2. You could use a clip and short the coil out from the bus bar ground to turns on the coil.

*Fig.1– Circuit of the 160 meter T match.*



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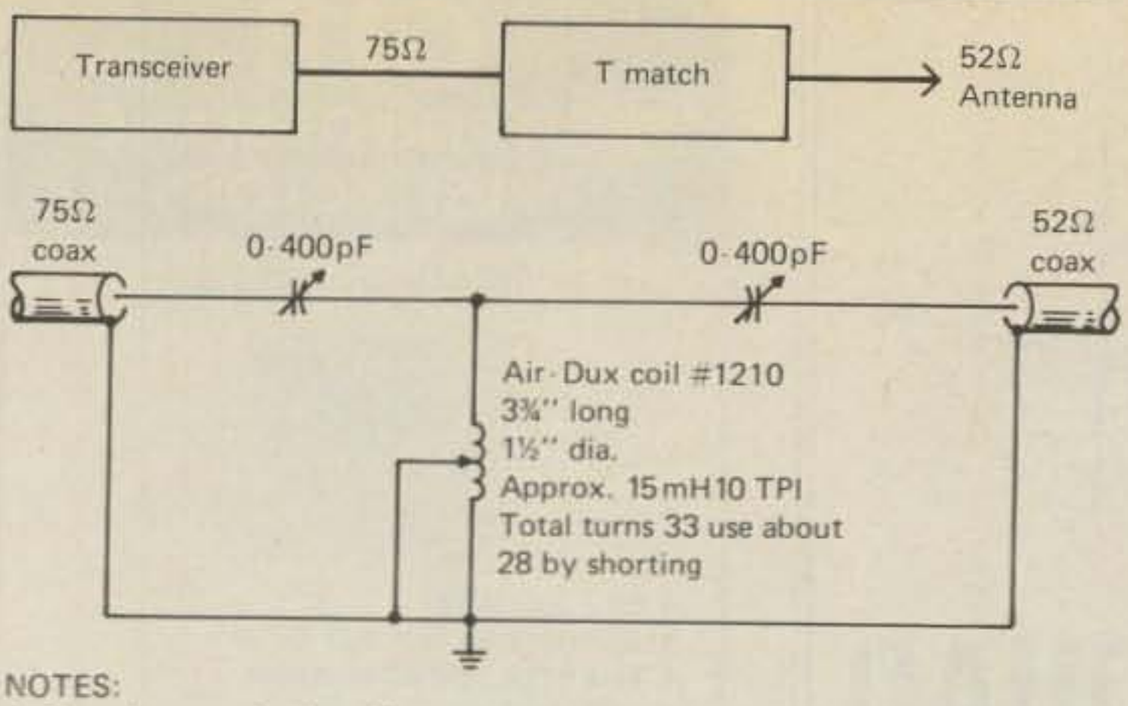


NOTES:
1. Capacitors are insulated from ground.
2. Peak capacitors for maximum output by watching a field strength meter or SWR meter. Short turns out to use as muxh capacity as possible near 400pF.

*Fig.2– Mechanical details of the 160 meter T match.*

## Construction

I needed a value of 0–400 pF for tuning capacitors. I was lucky enough to find several taken out of Swan transmitters at a fleamarket. These were two sections of 200 pF each with a spacing of 18 thousands (0.46 mm). They were parelleled and did not arc with 180 watts input. A normal BDC-type might arc.

Using these capacitors, I was able to build a small tuning unit into a Radio Shack Deluxe Metal Utility Cabinet 5¼ "W × 3 "H × 5⅞ "D. Before building your matcher, try it out on the bench and see how much space you need with the parts *you* can find! My cabinet was stock number 270-253, but you might find it easier to use a larger cabinet.

The capacitors were mounted on ¼-inch plastic for insulation, and holes were counter-sunk and secured with flat-head screws to clear the metal cabinet. Insulated shaft couplers were used, and a bushing was put in the panel for a bearing.

The coil used was Air-Dux #1210, 1½-inch diameter, 3¾ inches long, with a total of 33 turns. The coil is 10 turns per inch. I was able to mount a miniature 6-position switch above and in back of my coil by pressing in 5 of the turns. I tapped the turns every two turns up from the ground end. The coil was mounted on round insulators ¾-inch high. The capacitors are joined together by the frames to the top of the coil and junction of the capacitors. One set of stator plates go to the antenna, and the other capacitor stator plates go to the transceiver.[2]

## Adjustment

I put my T Matching unit at the transmitter output after tuning the transmitter into a 72 ohm load. I then matched the T match input capacitor to 72 ohms and the output capacitor to 52 ohms where I placed my filter. After initial adjustment, try reducing the coil inductance to where you use the most capacity for tuning nearly full mesh. Later I switched the T Match position to after the filter and still obtained the same results, although this is not the proper way to use it.

The T Match works the same as the Transmatch, and it is easier to obtain capacitors for 160 meters. Build one and keep it handy; you might need it. I sure did!

---

[1] *"Another Look At Reflections," M. Walter Maxwell,* QST, *Dec. 1974, p. 11, and previous articles of the series.*

[2] *Most of the parts probably can be obtained from RadioKit, Box 411, Greenville, NH 03048, or Fair Radio Sales Co., P.O. Box 1105, Lima, OH 45802. Write for their catalogs.*


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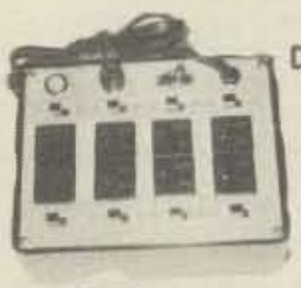

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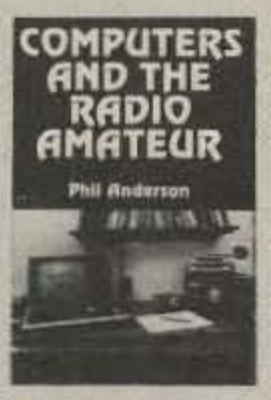

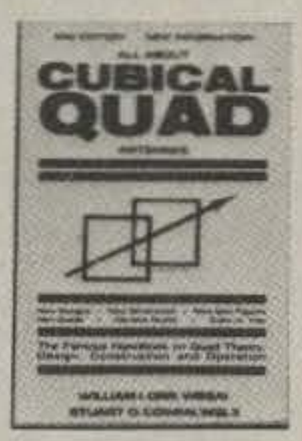

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# Novice

*a monthly feature by*
**BILL WELSH, W6DDB**

"HOW TO" FOR THE NEWCOMER TO AMATEUR RADIO

## Novice Band Code Nets

Net operation provides excellent code practice, which enables one to rapidly increase code proficiency. The information in Table I is primarily a rearrangement of facts provided by Mike Adams, N4EVS. I urge you to participate in nets to provide message handling service while improving your skill and knowledge. See notes one (1) and two (2) at the end of this list.

### Callsign Plates for California Novices

California Novices may apply for automobile license plates showing their amateur radio callsigns as of 1 January 1983. The restriction that has existed was based on the fact that Novice licenses were not renewable until recently. If you are a Novice in one of the states that has not made this updating change, I hope you will contact your state Assemblyman to correct this situation.

### Australian Award

Australian Novices are allowed to operate single sideband (s.s.b.—voice) on 3550–3625 kilohertz, plus 21.15–21.2 and 28.3–28.6 megahertz, at 30 watts maximum peak envelope power (PEP). They also have code operating privileges on 3525–3625 kHz, plus 21.125–21.2 and 28.1–28.6 MHz, at 10 watts d.c. maximum input power to the r.f. final amplifier stage. Australian and American Novices share the use of 21,125–21,200 and 28,100–28,200 kHz. General (and higher) class American amateurs can also work Australian Novices on 28.5–28.6 MHz. Split-frequency operation provides many other opportunities to contact Australian Novices. This involves listening in one segment of a band (the Australian Novice segment, for example) and transmitting in another segment of the band (the American segment, in this case).

As an example of split-frequency operation, an Australian Novice could be making voice transmissions on some frequency between 28.3 and 28.5 MHz and could state that she/he is listening for a reply at some frequency (28.15 MHz, for example) in the U.S.A. Novice band. The American can transmit code in her/his band and listen to the Australian voice transmissions outside the American Nov-

*2814 Empire Ave., Burbank, CA 91504*

**Daily Nets (including weekends)**

| UTC(3) | kHz | I.D. | Name | Manager | Purpose(4) | Coverage |
|---|---|---|---|---|---|---|
| 0000 | 3710 | TSN | Tennessee Slow Net | NG4J | S | Tennessee |
| 0000 | 3723 | WNN | Wisconsin Novice Net | N9AUG | S | Wisconsin |
| 0000 | 3727 | KNTN | Kentucky Novice Training Net | KB4OZ | S | Kentucky |
| 0015 | 3708 | ICN | Indiana Code Net | N9AEI | S | Indiana |
| 0030 | 3705 | OLZ | Oklahoma Liaison Net | W5UYH | S | Oklahoma |
| 0030 | 3710 | NLS | N.Y., Long Island Slow Net | WB2EUF | S | N.Y.C. & Long Island |
| 0100 | 3705 | ITN | Illinois Training Net | KB9X | S-T | Illinois |
| 0100 | 3715 | QFNS | Florida Slow Speed Net | WA4PFK | S | Florida |
| 0100 | 3722 | MNN | Michigan Novice Net | WD8BHE | S | Michigan |
| 0130 | 3703 | LSN | Louisiana Slow Net | WB5IYH | S | Louisiana |
| 0130 | 3715 | EMRISS | E. Mass., R.I. Slow Speed | N1BHH | S | E. Mass.&R.I. |
| 0130 | 3722 | WMTN | W. Mass. Training Net | W1TM | O-T | W. Mass. |
| 0200 | 3706 | WCN | West Coast Slow Net | K7ZIG | S | Ore. & Wash. |
| 0200 | 3745 | TSN | Texas Slow Net | KB5TC | S | Texas |
| 0215 | 3710 | UCN | Utah Code Net | WA7KHE | S | Utah |
| 0230 | 3715 | CWN | Colorado, Wyoming Net | WDØAIT | S | Colo. & Wyo. |
| 0300 | 3702 | WCN | West Coast Slow Speed Net | K7ZIG | O-T | W. USA & Canada |
| 1100 | 3715 | EBN | Early Bird Net | NG4J | T | E. USA |
| 1230 | 3714 | HBSN | Hit & Bounce Slow Net | WB3GZU | T | E. USA |
| 2230 | 3710 | WISN | West Indies Slow | NP4D | S | West Indies |
| 2230 | 3722 | MNN | Michigan Novice Net | WD8BHE | S | Michigan |
| 2300 | 3715 | CNN | Carolina Novice Net | KA4ODX | S | N/S Carolinas |
| 2300 | 7115 | CNN | Carolina Novice Net | KA4ODX | S | N/S Carolinas |
| 2300 | 21150 | NIN | National, International Net | K6EA | E-O-T-W | Worldwide |
| 2300 | 21190 | NGCHN | Novice Gulf Coast HN | KA5ILR | W | Gulf states/ W.I. |
| 2315 | 3720 | NENN | New England Novice Net | WB1GQD | O-T | New England |
| 2315 | 3730 | WVNN | West Virginia Novice Net | WD8LDY | S | West Virginia |
| 2330 | 3708 | ONN | Ohio Novice Net | WD8QMP | S | Ohio |
| 2330 | 3725 | AEND | Alabama Emergency Net D | W4CKS | S | Alabama |
| 2330 | 3735 | NJSN | New Jersey Slow Net | WB2IQJ | S | New Jersey |
| 2345 | 3710 | MSSN | Minn. Slow Speed Net | WBØWXU | S | Minnesota |

**Monday Nets**

| | | | | | | |
|---|---|---|---|---|---|---|
| 0000 | 3710 | ACE | Adair County Emergency Net | WØOTF | E-O-T-W | Missouri |
| 0030 | 3735 | MTN | Maryland Training Net | K3ORW | S | Maryland |
| 0100 | 3733 | MSN | Mississippi Slow Net | KA5GGG | S | Mississippi |
| 2300 | 21110 | TNN | Transcontinental Novice Net | WA2KSM | (QRP) | USA |
| 2315 | 3718 | GTN | Georgia Training Net | — | S | Georgia |

**Tuesday Nets**

| | | | | | | |
|---|---|---|---|---|---|---|
| 0030 | 3735 | DSSN | Diamond State Slow Net | KA3DPR | S | Delaware |
| 0030 | 3737 | MTN | Maryland Training Net | N4DR | S | Maryland |
| 0100 | 3713 | ICN | Iowa Code Net | WDØHND | S | Iowa |
| 0100 | 3733 | MSN | Mississippi Slow Net | KA5GGG | S | Mississippi |
| 0130 | 3745 | TSN | Texas Slow Speed Code Training Net | KB5TC | S | Texas |
| 0700 | 7120 | MEN | Maui Emergency Net | KH6H | E-O-T-W | Hawaii |
| 2345 | 7135 | YAN | Young Amateurs Net | KA2KVZ | O-T | N. USA |

**Wednesday Nets**

| UTC(3) | kHz | I.D. | Name | Manager | Purpose(4) | Coverage |
|---|---|---|---|---|---|---|
| 0000 | 3710 | ACE | Adair County Emergency Net | WØOTF | E-O-T-W | Missouri |
| 0030 | 3737 | MTN | Maryland Training Net | W3UT | S | Maryland |
| 0100 | 3733 | MSN | Mississippi Slow Net | KA5GGG | S | Mississippi |



Say You Saw It In CQ

### Wednesday Nets

| UTC(3) | kHz | I.D. | Name | Manager | Purpose(4) | Coverage |
|---|---|---|---|---|---|---|
| 0100 | 7112 | ATEN | Albany Traffic Emergency Net | WB2ZCM | E-O-T | New York |
| 0200 | 21150 | ATEN | Albany Traffic Emergency Net | WB2ZCM | E-O-T | New York |
| 2300 | 28120 | TSRAC | Triple States Slow Code Net | N8DHB | O-T | PA/OH/W.VA. |
| 2315 | 3718 | GTN | Georgia Training Net | — | S | Georgia |

### Thursday Nets

| | | | | | | |
|---|---|---|---|---|---|---|
| 0000 | 28120 | TSRAC | Triple States Intermediate Net | N8DLK | O-T | Ohio |
| 0000 | 28125 | — | CQ Radio Club Novice Net | K1BCI | O-T | Connecticut |
| 0030 | 3735 | DSSN | Diamond State Slow Net | KA3DPR | S | Delaware |
| 0030 | 3737 | MTN | Maryland Training Net | N4DR | S | Maryland |
| 0100 | 3713 | ICN | Iowa Code Net | WD0HND | S | Iowa |
| 0100 | 3733 | MSN | Mississippi Slow Net | KA5GGG | S | Mississippi |
| 0100 | 3735 | RR2N | Red Rose 2nd Net | K3EIP | L | E. Penn. |
| 0200 | 21110 | OSCW | Omik Slow Code Net | WD8KAV | L | Ohio |

### Friday Nets

| | | | | | | |
|---|---|---|---|---|---|---|
| 0000 | 3710 | ACE | Adair County Emergency Net | W0OTF | E-O-T-W | Missouri |
| 0030 | 3737 | MTN | Maryland Training Net | KB3VP | S | Maryland |
| 0100 | 3733 | MSN | Mississippi Slow Net | KA5GGG | S | Mississippi |
| 0130 | 21114 | PHD | — | K0MAT | O-T | Kansas City Area |
| 2315 | 3718 | GTN | Georgia Training Net | — | S | Georgia |
| 2345 | 7135 | YAN | Young Amateurs Net | KA2KVZ | O-T | N. USA |

### Saturday Nets

| | | | | | | |
|---|---|---|---|---|---|---|
| 0100 | 3713 | ICN | Iowa Code Net | WD0HND | S | Iowa |
| 0130 | 3745 | TSN | Texas Slow Speed Code Training Net | KB5TC | S | Texas |
| 1400 | 3727 | KNTN | Kentucky Novice Training Net | KB4OZ | S | Kentucky |
| 1700 | 7110 | WINS | West Indies Slow Net | WP4BCV | S | West Indies |
| 1900 | 7105 | BRL | Braille Institute QRS Net | WB6ZPN | O | West Coast |
| 2130 | 3730 | TNT | Traffic and Training Net | WB0NIE | S | Missouri |
| 2130 | 3740 | LVN | Lehigh Valley Net | N3AIV | S | Pennsylvania (Lehigh & Northampton Counties) |

### Sunday Nets

| | | | | | | |
|---|---|---|---|---|---|---|
| 1330 | 3748 | WARC | Williamsburg ARC Net | K4JST | O-T | Virginia |
| 1400 | 3727 | KNTN | Kentucky Novice Training Net | KB4OZ | S | Kentucky |
| 1530 | 3710 | — | Tuolumne ARS Net 3 | — | — | Tuolumne Co. CA |
| 1630 | 3725 | SDN | San Diego Section ARES Net | — | T | S.D. & Imperial Cos |
| 1700 | 7110 | WINS | West Indies Slow Net | WP4BCV | S | West Indies |
| 1730 | 3735 | CBN | Cape Breton Net | — | S | Maritimes |
| 1900 | 7105 | BRL | Braille Institute QRS Net | WB6ZPN | O | West Coast |
| 2130 | 3730 | TNT | Traffic and Training Net | WB0NIE | S | Missouri |
| 2300 | 3735 | DSSN | Diamond State Slow Net | KA3DPR | S | Delaware |
| 2345 | 7135 | YAN | Young Amateurs Net | KA2KVZ | O-T | N. USA |

*Notes:*

(1) Please send additions and corrections in writing to Mike Adams, N4EVS, Route 4, Box 764, Panama City, FL 32405. The master list is frequently updated and valid inputs are welcome. Known net managers are supplied names and callsigns of amateurs requesting data in their areas.

(2) The February 1980 *CQ* Novice column covers Q-signals for amateur radio use, including the special ARRL Q-signals developed exclusively for net use. Reprints are available at $2.00 each from *CQ* Magazine, 76 North Broadway, Hicksville, NY 11801.

(3) UTC is Universal Time Coordinated; it can be considered to be the same as Greenwich Mean Time (GMT). Many nets change time ahead in the spring and back in the fall to match shifts between daylight savings and standard times. If you do not hear a net at an indicated time, simply listen one hour later or earlier, as appropriate. UTC is 4, 5, 6, and 7 hours ahead of EDST, CDST, MDST, and PDST, respectively. Some nets suspend operation during the summer when activity is low.

(4) A—area NTS (National Traffic System)
E—emergency preparedness net
L—local NTS net
O—other (miscellaneous) net
R—region NTS net
S—section NTS net
T—traffic net
W—weather net

*Table I– Novice band code nets.*

*The Jumbunna Award, earned by contacting 15 Victorian Novices (VK3).*

ice band. Similarly, the Australian Novice could make voice transmissions in the 28.3 to 28.5 MHz range and advise that she/he is listening for a reply at some frequency (28.9 MHz, for example) in the U.S.A. voice segment, where the responding American transmits.

The suffix of every callsign assigned to Australian Novices starts with K, N, P, or V. VK3NAJ and VK2PAJ are examples of Australian Novice callsigns. Australian Limited licensees (52 MHz and up) are issued callsigns including a suffix starting with K, X, Y, or Z. Notice that the K beginning suffix letter denotes the holder of a combination Novice and Limited license. The callsign of an Australian VK3 amateur with full operating privileges includes a suffix that starts with A, B, C, D, or E; VK3ALG is such a typical callsign.

The Australian Novice examination is a 5 w.p.m. code test, plus a written test that is similar to the one that Americans must pass to earn the Novice license.

The Jumbunna award is about 8″ × 12″ and it has the Victorian state coat-of-arms in the upper right corner, plus a map of the state in the lower left area. It is earned by contacting 15 Victorian Novices (VK3). Do not send QSL cards with your application for this award; simply write a sequential list of the VK3 Novices you contacted and have your list verified (and signed) by two amateurs who are not related to you. The list should include all contact information, such as date, time, mode, frequency/band, and callsign of station contacted.

There is a $3.00 (U.S.A.) fee associated with this award, which includes the cost of airmailing the award to you. If you prefer to send International Reply Coupons instead of cash, 12 IRCs should be sent. No starting or ending date is stated for this award. Applications should be sent to Chris Levingston, VK3AOR, 2 Acacia Avenue, Kilsyth 3137, Victoria, Australia. *Do not* use the address listed in the current callbook.

## Station Installation Information

L.B. Cebik, W4RNL, has written a book which can be very helpful to new and prospective amateurs installing their first stations. Entitled *Setting Up and Using Your Own Ham Shack,* this 308-page TAB paperback includes 194 illustrations, and

*These are the members of the Rockaway Beach Junior High School Radio Club in Rockaway Park, New York. Left to right, they are Steven Solomon, KA2MHV, Gerry Skloot, KE2N, Juan Alessandri, KA2MJH, Thomas Witelski, KA2JTF, Christopher Carlo, KA2JZE (seated), and Scott Wentnick, KA2MHX. Their amateur radio instruction and operation occurs before and after normal school hours. Their station includes a Kenwood TS-520SE transceiver, Hy-Gain 5-DBQ trap dipole antenna, and an MFJ antenna tuner. They have already contacted amateurs in 40 states, 50 countries, and all continents. This group reports that these Novice columns have been very helpful.*

it contains information that can help the most experienced operators improve their stations. Accessory, antenna, equipment, and radio shack considerations are detailed in this excellent book. It is available through *CQ*'s Book Shop for $10.95 plus shipping. My "Amateur Radio Installation Tips" article in the November 1977 through March 1978 *CQ* Novice columns contains additional information regarding this subject. I strongly urge you to set up a functional, efficient, and comfortable station to really enjoy amateur radio.

## Operating Etiquette

Cliff Harmon, KA4YIZ, hopes that some of the more proficient code operators will display a little more patience with those who have lower top code receiving capabilities. He states that it is demoralizing to hear a response at 15 to 20 w.p.m. when he sends the CQ call at 10 w.p.m. because that is his top code receiving speed. As is true with most new amateurs, he greatly appreciates those people who slow down (QRS) for him. There is no real two-way communication when the receiving speed of either operator is exceeded.

The other major operating irritation Cliff mentioned involves domestic (U.S.A.) amateurs calling CQ on a frequency immediately following his CQ DX (long distance) call on the same frequency. He reports that this poor practice has caused him to lose several DX contacts. He detailed instances wherein foreign amateurs answered his CQ DX calls, but were obliterated by stronger local amateurs who also were answering him. DX simply represents distance, and a DX station is simply one located far from the calling station's location. When operating on 160, 80, or 40 meters, amateurs in distant states can be considered to be DX; this is particularly true to newer amateurs. However, when operating on 10, 15, or 20 meters, it is safe to assume that an amateur calling CQ DX only wants foreign amateurs to respond.

Part of this problem can be overcome by sending DX following your last station callsign identification and preceding the invitation to transmit (K). This operating procedure minimizes the possibility of unwanted local (domestic) responses from amateurs who just heard the station identification and do not know the calling station just wants DX amateurs to respond.

Your cooperation in this matter can make it possible for many amateurs to enjoy more exciting long-distance contacts. Experienced operators calling CQ DX just want amateurs in foreign countries to answer their calls.

Cliff advised that the Novice column in *CQ* has been a great help to him. It would be appreciated if all operators would read the operating tips in the August through November 1981 issues.

## Feedback

It is nice to receive letters and cards from people who read this column, and I receive such correspondence in almost every mail delivery. On-the-air comments from readers are also common. Most of the written correspondence includes requests for information that has been printed in previous Novice columns.

The article that evoked the top response so far is the June 1981 column about code not being c.w. Most of the people who wrote to me about that article advised that they had never thought about it; they had simply accepted the old and incorrect term. The radio telegraph emissions from early spark gap transmitters were called spark emissions. It is easy to understand that when tubes came into use (in the final amplifier stages of transmitters) the resultant radiotelegraph emissions were called continuous wave (c.w.), since they are composed of a continuous train of radio waves broken up into a code sequence. Despite the wide acceptance of the term c.w. to designate radiotelegraph emissions, it is simply incorrect. If you have not read my Novice column on this subject, I hope you will do so. Elimination of this incorrect terminology is decades overdue. Two of the organizations that advise the International Telecommunications Union (ITU) regarding radio matters are the International Radio Consultative Committee (CCIR) and the International Telegraph and Telephone Consultative Committee (CCITT). I heard from one member of each of these committees. Both of these knowledgeable people concur that it is incorrect to call radiotelegraph (code) signals continuous wave (c.w.). Further more, CCIR member Bob Eldridge, VE7BS, advised that he intends to discuss this matter with others on the same committee.

Keep your letters coming, but please remember to include a self-addressed and stamped envelope. Most requests are answered by sending printed material. The written items are cheap enough, but the postage gets expensive when answering a lot of mail.

The January 1982 Novice column includes an item about help being available to prospective and new amateurs. This service has been mentioned previously, and it always caused me to receive about 30 letters from people seeking help. However, the help-available item was the opening thing in the January issue, and it brought in more than 200 requests for help within two weeks. Fortunately, that item also prompted about 20 more amateurs to volunteer their help to newcomers. Every letter has been answered, and I am thankful that most people enclosed their s.a.s.e.

If you are willing to help newcomers to amateur radio, please let me know in writing; send your name, callsign, mailing address, and (if agreeable) telephone number. I do not have ten percent of the coverage that is needed to answer continuing requests. There must be a lot of active amateurs who are willing to help make it easier for those who need assistance in getting a proper start in our amateur radio service. If you are one of these amateurs, I want to hear from you. If you know someone who provides this service, please tell her/him that I need their help. Last but not least, if you need help getting into amateur radio, please let me know. The FCC office at Gettysburg, Pennsylvania, has a special telephone number one can call to request information; it is 717-337-1511.

## W2HAE Comments

Art Ford, W2HAE, is another amateur like myself who enjoys contacting newer amateurs in the Novice bands. He offers the following suggestions to help make Novice band operation more pleasant:

**(1)** When operating on 40 meters at times when international shortwave stations are being heard here in ITU Region II (Americas), select frequencies between those stations. Since foreign broadcast stations operate evey 5 kHz (7105, 7110, etc.), frequencies ending in 2, 3, 7, or 8 (7112, 7113, 7117, 7118, for example) are less likely to suffer from interference, and they should be used at those times.

**(2)** Avoid repeating things such as RST, name, and QTH. Simply send the related information twice without repeating the lead-in term each time. As an exam-



Say You Saw It In CQ

*Sixteen-year-old Curtis Wyse, OA8CW, of Peru is a Novice who lives near Pucallpa in the jungle. Curtis advises that Peruvian Novices are allowed to operate code and s.s.b. (voice) on 3500–4000 and 7100–7150 kHz using up to 100 watts. Curtis can usually be heard on 7102 kHz from 1000–1100 UTC. He has contacted 41 states, 39 countries, and all continents (including Antarctica) in less than 6 months on the air. He averages more than 4 contacts per day. Curtis shares the use of an amateur radio station with his father (Paul, OA8V) who appeared on the front cover of the April 1977 CQ. Their station includes a Ten-Tec Argonaut 515 transceiver, Ten-Tec 405 50-watt amplifier, Drake R-4B receiver, 80 meter dipole, and a 40 meter 2-element delta loop.*

ple, send NAME IS ART ART, not NAME IS ART NAME IS ART.

**(3)** Avoid sending words that add nothing to the meaning of what you are saying. As an example, send RIG IS CENTURY 21 instead of sending THE RIG HR IS A TEN TEC CENTURY 21 TRANSCEIVER. Brevity is an excellent trait to develop on the air, and later it can be put to good use when initiating message traffic.

**(4)** When experiencing man-made interference (QRM) on a frequency during a contact, check a few kilohertz above and below the present frequency to find a clear spot. Tell the other operator that QRM exists and ask if she/he is willing to shift to the clear frequency you located. If so, move to the new spot and use a short call to confirm that the other operator has found your signal again. Remember that QSY (YOU) is telling the other amateur to shift frequency, whereas QSW (WE) is stating that you will shift frequency. When making this type of minor frequency change, it is an acceptable practice to send a series of V's as one slowly shifts to the new frequency; this allows the other operator to easily follow you to the new spot. Try it and you will like it much better than struggling through interference. If the QRM is extremely overpowering, just send something like UP 3 or DOWN 2 to let the other operator know where you are going. However, make sure that the other amateur understands what you are doing before you leave the frequency you have been using.

73, Bill, W6DDB


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**C.W.: January 28–30 Starts: 2200 GMT Fri.**
**S.S.B.: February 25–27 Ends: 1600 GMT Sun.**

With the increasing number of countries now on 160 meters, and an increase in stateside activity now that a larger portion of the band is available, it became apparent that the old scoring system has become antiquated. Therefore, we have made a complete change in the QSO point values, which should make the scoring more equitable world wide. There will still be some inequities, but hopefully they will only affect a minimum number of stations.

It is still essential that the "DX Window" (1825 to 1830 kHz) be kept free of U.S. and VE activity so that the DX stations can be heard and worked split frequency. It probably will be necessary to make other operating adjustments when a more definite pattern is established by overseas stations—perhaps extending the Window to 1835 kHz, since some countries do not allow operation below 1830 kHz. However, for the time being we think we have taken a step in the right direction with this new format.

**Classes:** Both single operator and multi-operator (maximum of 5 ops per station).

**Exchange:** RS(T) and QTH. State for U.S., province for Canada, and country for all others. (QSO number has been eliminated.)

**Scoring:** Contacts with stations within own country, 2 points. Contacts with stations in other countries but in the same continent, 5 points. Contacts with stations in other continents, 10 points. (KH6 and KL7 are considered countries.)

**Multiplier:** Each U.S. state, VE province, and DX country. (U.S. and Canada not a country multiplier for W/K or VE/VO. There are three VE1 provinces: New Brunswick, Nova Scotia, and Prince Edward Is.)

**Final Score:** Total QSO points times the sum of the multipliers. (Maritime mobile scoring will be determined by the location.)

**Penalties:** Three additional contacts will be deleted from the score for each duplicate, false, or unverifiable contact removed from the log. A second multiplier will also be removed for each one lost by the above action.

**Disqualification:** Violation of the rules and regulations pertaining to amateur radio in the country of the contestant, violation of the rules of the contest, unsportsmanlike conduct, or taking credit for excessive duplicate contacts or multipliers will be deemed sufficient cause for disqualification.

Disqualified stations or operators may be barred from competing in future *CQ* contests for a period of up to three years.

**Awards:** Certificates to the top scorers in each U.S. state, VE province, and DX country, both c.w. and s.s.b. and for both classes.

Plaques to the top U.S. and top European station, both c.w. and s.s.b., donated by the West Gulf A.R.C.

The W0AW Memorial Plaque to the World 160 C.W. Champion is again being donated by "Friends of John Doremus."

The new Charlie O'Brien, W2EQS, Memorial Plaque to the World 160 S.S.B. Champion will this year be donated by Bernie Welch, W8IMZ, and Frank Anzalone, W1WY.

The above plaques may be won once only by the same station within a three-year period. Winner of the World Plaque will not also be considered for a sub-area award. That award goes to the runner-up of that area.

Sample log and summary sheets may be obtained from *CQ* by sending a large s.a.s.e. with sufficient postage to cover your request. It is not necessary to use the official forms. You can make up your own, 40 contacts to the page, time in GMT, exchange sent and received, and separate columns for QSO points and multipliers. Indicate the multiplier only the first time it is worked.

Mailing deadline for c.w. entries is February 28th, and March 31st for the s.s.b. section.

Logs can be sent directly to the 160 Contest Director, Don McClenon, N4IN, 3075 Florida Avenue, Melbourne, FL 32901 USA. They can also be sent to *CQ* 160 Meter Contest, 76 North Broadway, Hicksville, NY 11801 USA. *(Please indicate c.w. or s.s.b. on the envelope.)*

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| HBX56 | 56 ft | 10 sq ft | 385 | BXB8 | 419 | 30 | 449 |
| HDBX40 | 40 ft | 18 sq ft | 281 | BXB7 | 313 | 26 | 339 |
| HDBX48 | 48 ft | 18 sq ft | 363 | BXB8 | 399 | 30 | 429 |

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| AV5 | 80-10 mtr. Trap Vertical | $ 95 |
| 20-3CD | 3-El. 20 mtr. Beam | $179 |
| 20-4CD | 4-El. 20 mtr. Beam | $239 |
| 15-3CD | 3-El. 15 mtr. Beam | $ 99 |
| 15-4CD | 4-El. 15 mtr. Beam | $109 |
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| 214B | 14-El. 2 mtr. "Boomer" | $ 69 |
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| 228FB | 28-El. 2 mtr. FM "Power Pack" | $189 |
| 32-19 | 19-El. 2 mtr. "Super Boomer" | $ 83 |
| 220B | 17-El. 220 MHz "Boomer" | $ 75 |
| ARX2B | 2 mtr. "Ringo Ranger II" | $ 36 |
| ARX450B | 450 Mhz "Ringo Ranger II" | $ 38 |
| A147-20T | 2 mtr. Vert. & Horiz. 10-El. Beam | $ 63 |
| A144-10T | 10-El. 2 mtr. Satellite Antenna | $ 45 |
| A144-20T | 20-El. 2 mtr. Satellite Antenna | $ 69 |
| A432-20T | 20-El. 432 MHz. Satellite Antenna | $ 45 |
| A14T-MB | Dual Antenna Mounting Assembly | $ 25 |

MANY OTHER CUSHCRAFT ANTENNAS IN STOCK – CALL!

### HYGAIN

| | | |
|---|---|---|
| V2S | New 2 mtr. Base Vertical | $ 39 |
| TH5MK2S | New Broad Band 5-El. Triband Beam | $319 |
| TH7DXS | New Broad Band 7-El. Triband Beam | $379 |
| TH3MK3S | 3-El. Triband Beam | $219 |
| TH3JRS | 3-El. Triband Beam | $159 |
| TH2MK3S | 2-El. Triband Beam | $139 |
| HY-QUAD | 2-El. Triband Quad | $279 |
| 402BAS | 2-El. 40 mtr. Beam | $199 |
| 205BAS | 5-El. 20 mtr. "Long John" | $299 |
| 155BAS | 5-El. 15 mtr. "Long John" | $179 |
| 105BAS | 5-El 10 mtr. "Long John" | $119 |
| 204BAS | 4-El. 20 mtr. Beam | $229 |
| 203BAS | 3-El. 20 mtr. Beam | $139 |
| 153BAS | 3-El. 15 mtr. Beam | $ 79 |
| 103BAS | 3-El. 10 mtr. Beam | $ 59 |
| DB1015AS | 3-El. 10/15 mtr. Beam | $159 |
| 64BS | 4-El. 6 mtr. Beam | $ 55 |
| 66BS | 6-El. 6 mtr. "Long John" | $109 |
| 18HTS | 80-10 mtr. Hy-Tower Vertical | $339 |
| 18AVT/WBS | 80-10 mtr. Trap Vertical | $ 95 |
| 214 | 14-El. 2 mtr. Beam | $ 35 |
| 2BDQ | 80/40 mtr. Trap Dipole | $ 49 |
| 5BDQ | 80-10 mtr. Trap Dipole | $ 99 |
| BN86 | 80-10 mtr. KW Balun | $ 19 |

### HUSTLER

| | | |
|---|---|---|
| 3TBA | New 3-El. Triband Beam | $199 |
| 4BTV | 40-10 mtr. Vertical | $ 79 |
| 5BTV | 80-10 mtr. Vertical | $ 99 |
| G6-144B | 2 mtr. Base Vertical | $ 69 |
| G7-144 | 2 mtr. Base Vertical | $ 99 |

| HF Mobile Resonators (STD 400 Watt) | | Super 2 KW) |
|---|---|---|
| 10 & 15 mtrs. | $10 | $15 |
| 20 mtrs. | $12 | $18 |
| 40 mtrs. | $15 | $21 |
| 75 mtrs. | $17 | $32 |

BUMPER MOUNTS, SPRINGS, FOLDING MASTS IN STOCK CALL!

### KLM

| | | |
|---|---|---|
| KT34A | 4-El. Tribander | $309 |
| KT34XA | 6-El. Tribander | $469 |
| 7.2-1 | 40 mtr. Rotatable Dipole | $159 |
| 7.2-2 | 2-El. 40 mtr. Beam | $299 |
| 7.2-3 | 3-El. 40 mtr. Beam | $449 |
| 7.0-7.3-4A | 4-El. 40 mtr. Beam | $629 |
| 144-148-13LB | 13-El. 2 mtr. Long Boomer | $ 79 |
| 432-16LB | 16-El. 432 Mhz. Long Boomer | $ 69 |
| 144-150-16C | 16-El. 2 mtr. Circular Pol. Beam | $ 99 |
| 420-450-18C | 18-El. 435 MHz. Circular Pol. Beam | $ 59 |

CALL FOR OUR LOW PRICES ON OTHER KLM PRODUCTS!

### MINI PRODUCTS

| | | |
|---|---|---|
| HQ-1 | Mini-Quad Compact 20/15/10 mtr. Antenna | $139 |

### MOSLEY

| | | |
|---|---|---|
| CL-33 | 3-El. Triband Beam | $229 |
| TA-33 | 3-El. Triband Beam | $199 |
| TA-33 Jr. | 3-El. Triband Beam | $149 |
| S-402 | 2-El. 40 mtr. Beam | $279 |

### ROTORS & CABLES

| | |
|---|---|
| Alliance HD73 (10.7 sq. ft. Rating) | $ 99 |
| Alliance U100 (For small beams & Oscar Elev. Rotor) | $ 45 |
| Ham 4 (15 sq. ft. Rating) | $199 |
| Tailtwister (20 sq. ft. Rating) | $249 |
| HYGAIN HDR-300 (Most HD. Rotor for BIG Arrays) | $439 |
| 8 COND (2-#18 GA/6-#22 GA) Rotor Cable | $0.19/ft. |
| H.D. 8 COND (2#16GA./6#18GA.) Rotor Cable | $0.36/ft. |

### COAXIAL CABLE & CONNECTORS

| | |
|---|---|
| RG213/U (95% shield - non-contaminating jacket) | $0.29/ft. |
| RG8X (95% shield-non contaminating jacket) | $0.18/ft. |
| RG11/U (75 OHM - 95% shield) | $0.35/ft. |
| ½" Aluminum Hardline w/poly jacket | $0.69/ft. |
| ½" Copper Hardline w/poly jacket | $1.10/ft. |
| ½" Alum. H.L. Conn (UHF or N - Male or Female) | $15.00 |
| ½" Copper H.L. Conn (UHF or N - Male or Female) | $22.00 |
| Amphenol Silver Plate PL259 | $ 1.25 |
| Amphenol Nickel Plzte PL259 | $ 0.90 |
| Amphenol N Type Male Conn For RG213/U | $ 2.95 |

### HYGAIN CRANKUPS

| | | |
|---|---|---|
| HG37SS | 37 ft. Self Supporting | $669 |
| HG52SS | 52 ft. Self Supporting | $949 |
| HG54HD | Heavy Duty 54 Ft. Self Supporting | $1499 |
| HG70HD | Heavy Duty 70 Ft. Self Supporting | $2399 |
| HG50MT2 | 50 ft. Side Supported | $779 |

ALL HYGAIN TOWERS FREIGHT PAID! CALL FOR PACKAGE QUOTE ON TOWER, ANTENNA & ROTOR—FREIGHT PAID.

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20G-$32.00 25G-$41.50 45G-$93.50

| | | |
|---|---|---|
| HBX32 | 32 ft. Free Standing (rated 10 sq. ft.) | $169 |
| HDBX32 | 32 ft. Free Standing (rated 18 sq. ft.) | $189 |
| HBX40 | 40 ft. Free Standing (rated 10 sq. ft.) | $229 |
| HDBX40 | 40 ft. Free Standing (rated 18 sq. ft.) | $259 |
| HBX48 | 48 ft. Free Standing (rated 10 sq. ft.) | $289 |
| HDBX48 | 48 ft. Free Standing (rated 18 sq. ft.) | $319 |
| HBX56 | 56 ft. Free Standing (rated 10 sq. ft.) | $349 |
| FK2548 | 48 ft. 25G Foldover Tower | $789 |
| FK2558 | 58 ft. 25G Foldover Tower | $879 |
| FK2568 | 68 ft. 25G Foldover Tower | $959 |
| FK4544 | 44 ft. 45G Foldover Tower | $1099 |
| FK4554 | 54 ft. 45G Foldover Tower | $1219 |
| FK4564 | 64 ft. 45G Foldover Tower | $1329 |

Foldover Towers Freight Paid-10% Higher West of Rockies.
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### GALVANIZED STEEL TWR. HARDWARE

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| 3/16" EHS Guywire (3990 lbs.) | $12/100 ft. | $111/1000 ft. |
| 1/4" EHS Guywire (6000 lbs.) | $15/100 ft. | $139/1000 ft. |
| 5/32" 7 x 7 Aircraft Cable (2700 lbs.) | | $11/100 ft. |
| 3/16" CCM Cable Clamp (3/16" or 5/32" Cable) | | $0.30 |
| 1/4" CCM Cable Clamp (1/4" Cable) | | $0.40 |
| 1/4" TH Thimble (fits all sizes) | | $0.25 |
| 3/8 EE (3/8" Eye & Eye Turnbuckle) | | $5.50 |
| 3/8 EJ (3/8" Eye & Jaw Turnbuckle) | | $6.50 |
| 1/2 EE (1/2" Eye & Eye Turnbuckle) | | $8.50 |
| 1/2 EJ (1/2" Eye & Jaw Turnbuckle) | | $9.50 |
| 3/16" Preformed Guy Grip | | $1.65 |
| 1/4" Preformed Guy Grip | | $1.85 |
| 6" Diam - 4 ft. Long Earth Screw Anchor | | $12.50 |
| 2" Diam - 10 ft. Long Heavy Duty Steel Mast | | $39.00 |
| 500D Guy Insulator (5/32" or 3/16" Cable) | | $0.95 |
| 502 Guy Insulator (1/4" Cable) | | $1.95 |
| 5/8" Diam - 8 ft. Copper Clad Ground Rod w/clamp | | $11.00 |

### ANTENNA WIRE & ACCESSORIES

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|---|---|
| 14 Ga. Solid Copperweld (Multiples of 50 ft.) | $5/50 ft. |
| 14 Ga. Stranded Copper (Multiples of 50 ft.) | $5/50 ft. |
| 14 Ga. Stranded Copper (70 ft. coil) | $ 7.00 |
| 14 Ga. Stranded Copper (140 ft. Coil) | $ 14.00 |
| 18 Ga. Copperweld (1/4 mile spool) | $30.00 |
| Heavy Duty B&W End Insulator | $4/Pair |
| HYGAIN Model 155 Center Insulator | $ 5.95 |
| HYGAIN Model 157 Center Insulator w/SO239 | $11.95 |
| 450 OHM H.D. Low Loss Ladder Line | $ .14/ft. |

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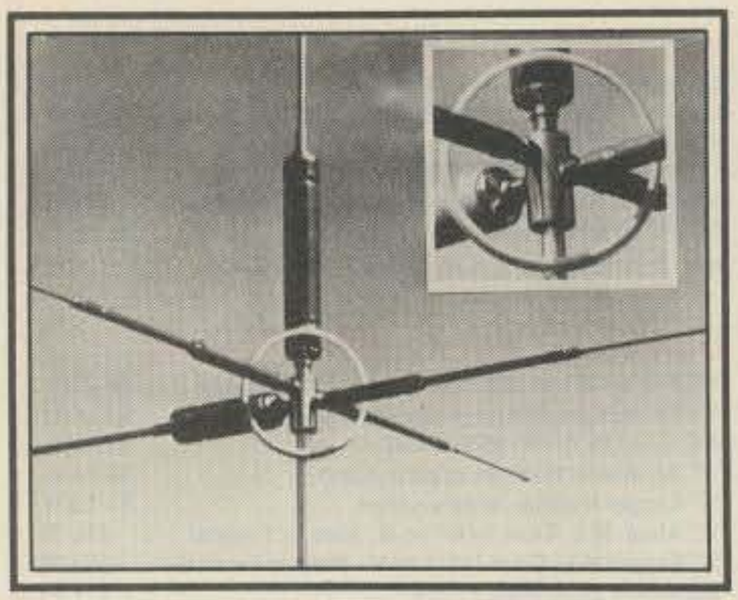
CIRCLE 122 ON READER SERVICE CARD

# CQ SHOWCASE



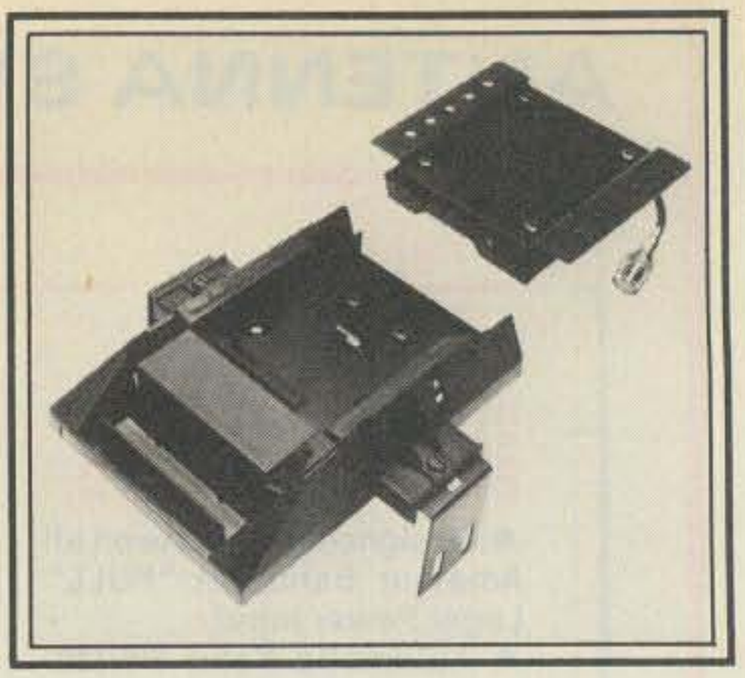
## JL Industries X-Panda-Five

This one to five band coupler is aluminum hub precision machined with five steel 3/8 × 24 rust-proof hi-tensil carbide studs, and makes a Hustler or Hy-Gain (or the equivalent) antenna into a five band mobile with the appropriate coils added. When the X-Panda is installed with the proper resonators, you can change bands without stopping your vehicle. Each resonator tuned to the desired frequency eliminates the need for an antenna tuner. Adding the X-Panda adapter to the antenna with the appropriate resonators and added ground planes will make an antenna system for apartments and condominiums. It can also be used to make multi-band antenna systems for RV's.

For more information, contact JL Industries, P.O. Box 030413, Ft. Lauderdale, FL 33303, or circle number 104 on the reader service card.

## Larsen QUIK-Change™

Larsen Antennas' new QUIK-Change™ Radio Mount system lets you change your mind—and your radio—fast. The new mount allows temporary expansion of a delivery fleet, interchangeable use on farm equipment, or easy removal for protection against theft from unattended vehicles. Transfers take only a minute. Radio malfunctions can be checked quickly, and replacements can be installed easily in any vehicle. The QUIK-Change is tough enough to stand heavy equipment vibration.



There are no manual connections—just a simple latch release that disconnects the positive power lead, then the ground and speaker leads, and the antenna connection. Reinsertion connects positive power last to protect the radio. First-class connectors are used throughout with connections provided for power, ground, and speaker screw terminals. The complete QUIK-Change mount sells for $36.00. For more information, contact Larsen Electronics, Inc., 11611 N.E. 50th Ave., P.O. Box 1799, Vancouver, WA 98668, or circle number 101 on the reader service card.





NEWS BULLETIN

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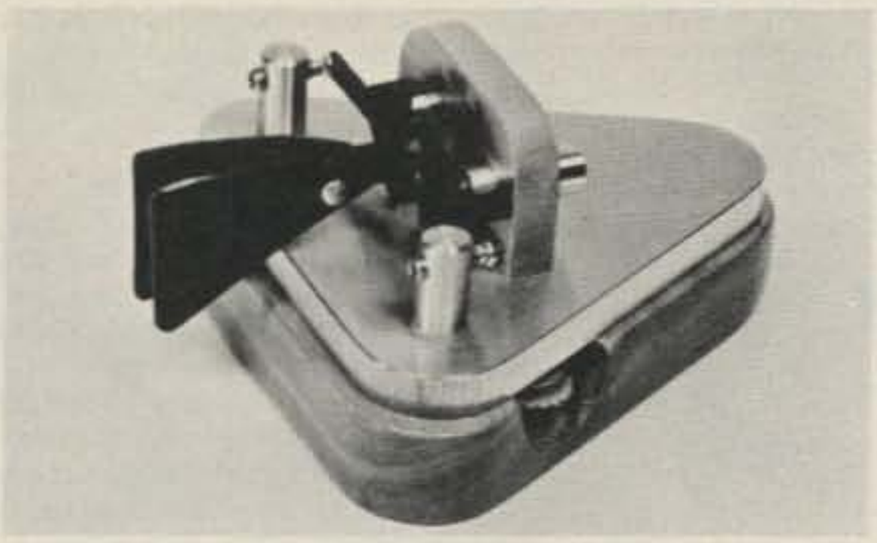
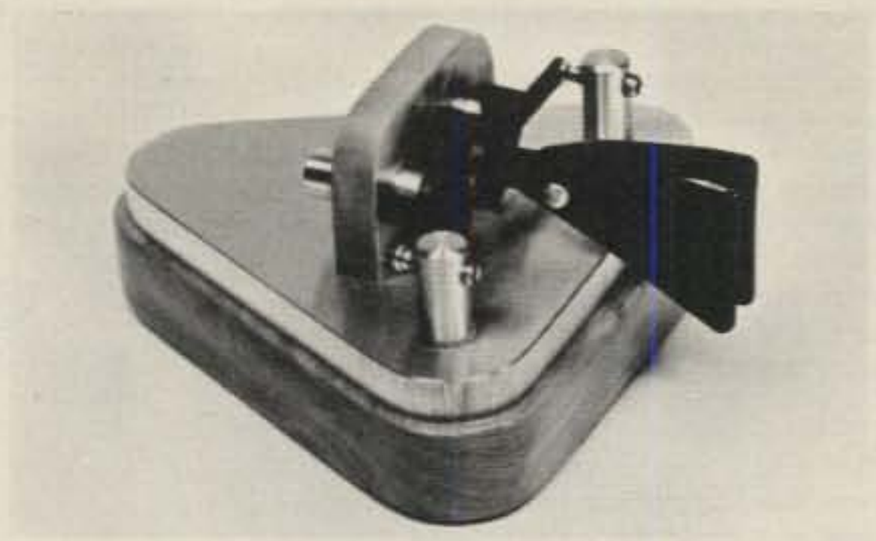
CIRCLE 147 ON READER SERVICE CARD




Say You Saw It In CQ

# "Our Keys Unlock the World"





The **Brass Racer-EK-1**, look carefully, you may not notice that this paddle is also a keyer. Built into the base is a fully iambic, dot-dash insertion, and adjustable speed control keyer using the Curtis 8044 chip. Nearly invisible but a convenient, spacesaving, portable keyer/paddle unit. **Vibroplex** quality throughout.

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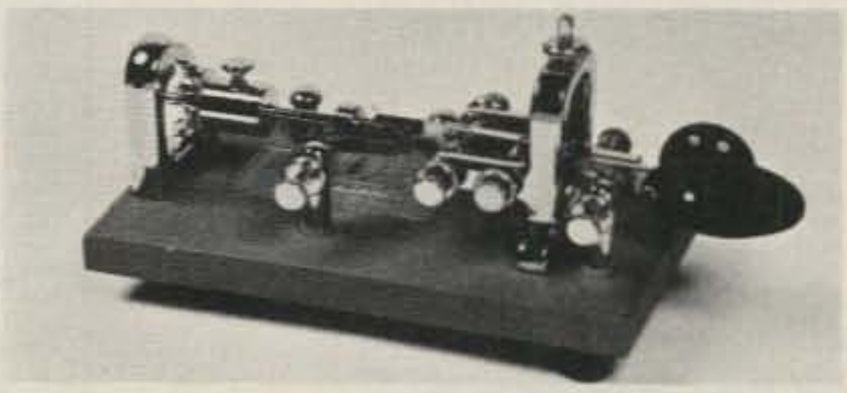
"the oldest name in amateur radio"



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CIRCLE 61 ON READER SERVICE CARD

# THE SPIRIT OF ADVENTURE

This expedition will demonstrate that a small dedicated party with minimal resources can reach the Antarctic with safety in a small sailing vessel.

Once ashore the party will carry out an ambitious programme of adventure and research against a backdrop of gales and blizzards, amongst teaming Antarctic wildlife.

Due to the size limitations of the yacht, the difficulties of landing on the island and the nature of the expedition's objectives, only essential survival equipment will be taken.

Through the success of this venture we hope to remind people that the achievements of yesterdays explorers are not a thing of the past. The challenges are still formidible, despite some advantages from advancing technology.

Achievement of our objectives may stimulate other adventurers to undertake similar expeditions and prosper the spirit of co-operative achievement so essential to the health and integrity of our community.

## Activities

The Heard Island Expedition has evolved from the aspirations of a multi-disciplinary team, brought together by a common desire to visit this isolated region.

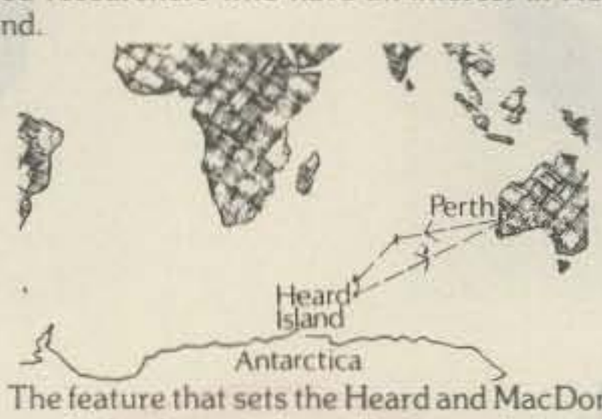
The scope of the activities proposed is wide ranging and challenging. Base Camp will be established at Atlas Cove, the site of the 1947-1955 Australian National Antarctic Research Expedition station, now in ruins.

From an advance base camp at Spit Bay, a group of mountaineers supported by scientists and film crew, will attempt the ascent of Big Ben. The route to the summit will take them over the Stephenson Glacier and Long Ridge. Gale force winds and driving rain and blizzards make this climb a formidable challenge and a major objective of Antarctic mountaineering.

Whilst the mountaineers do battle with Big Ben, our DX radio operators will be working continuously from Atlas Cove, making contact with an estimated 50,000 amateur radio enthusiasts in over 200 countries. From Iceland to the Soviet Union, Japan to Saudi Arabia, the voice of Heard Island will come to life, allowing operators from every continent to communicate with VKØHI, "the most wanted contact in the world".

A small party of scientists and photographers travelling by inflatable surf rescue boats, will complete the first circumnavigation of the rugged coastline by small craft. Landing on beaches previously untrodden, they will carry out surveys of wildlife populations, helping to assemble a more complete picture of the most remote parts of this remote island.

In the scientific component of the Expedition, it is not the group's intention to initiate any research programmes but rather to collaborate with established researchers who have an interest in Heard Island.




The feature that sets the Heard and MacDonald group of islands apart from all other sub-Antarctic islands is that they are not plagued by plants or animals introduced by man. Cats, rats, mice, rabbits and reindeer have caused major changes to the ecosystems of most other islands in the region.

The area is home to vast wildlife populations; giant elephant seals weighing many tonnes, penguin rookeries providing a haven for millions of birds, and skies alive with the graceful aerobatics of albatross, petrels and gulls. Together with a simple flora, highly adapted to the rigorous climate, the living environment is of great interest to biologists. Other scientists are intrigued by the advance and retreat of some of the fastest moving glaciers in the world, and an active volcano still awaiting adequate study.

The Expedition currently has 20 different research projects under consideration in fields as diverse as geo-physics, limnology, glaciology and terrestrial biology.

All field parties will document their discoveries photographically. A complete record of Heard and the nearby McDonald Islands will assist the Australian Heritage Commission in its moves to have this territory placed on the Register of the National Estate and proclaimed as a World Heritage Area.

Visits to Antarctica by professional artists are rare. Aspiring to the traditions of Edward Wilson of Scott's 1911 Polar Expedition, our artist will be the first to accompany a group to Heard Island. The grandeur, isolation and beauty of Heard Island will be described in a major exhibition of paintings, prepared from detailed field sketches and observations upon the Expedition's return.

Braving all weathers, a professional film crew will record the trials of a long ocean voyage and the drama and triumphs of adventure and discovery once ashore. A full length television documentary of unique content will result.

## The Costs

The Heard Island Expedition needs your help and encouragement. Each member is an expert in their own chosen field and is giving up all income and comforts for the duration of this expedition. Each member has contributed $3,000 to the Expedition Fund and together with generous grants from participating organisations, the vessel's charter fee has been covered. However we still have a long way to go in order to provide all the vital equipment for an exacting endeavour such as this.

You can help by becoming an Associate Member.

## Associate Membership

As an Associate Member you will become a vital part of our team. You will make a very real contribution to this unique adventure and as a consequence, share in the feelings of satisfaction and success from its achievements.

In recognition of your contribution you will receive an illustrated presentation certificate, designed by the Expedition's artist, together with a commemorative philatelic envelope, carried by the party to Heard Island and stamped with a commemorative cachet.

The Expedition's Newsletter will be forwarded to you every two months. It will provide you with detailed information on personnel, preparations, the destination and news of the Expedition whilst away.

Associate Members will receive a complimentary pass to pre-departure lectures and farewell party. Upon the Expedition's return you will be invited to attend the Heard Island Film and Exhibition previews and audio-visual presentations.

In addition, Associate Members will be able to purchase the Expedition's T-shirts, poster, magazine and car sticker. Major concessions will be offered on a high quality book and limited edition art prints forming a lasting record of the 1983 Heard Island Expedition and your association with it.

## The Expedition Needs Your Involvement — Now!

## The Expedition 'T' Shirt

Hand printed by the expeditioners. Available in all sizes — when ordering, include Australian metric size or chest measurement — for children, specify age. Allow 4 to 6 weeks for printing and postage.

Expedition Sloppy Jo's available with the same design.

The Associate Members Certificate

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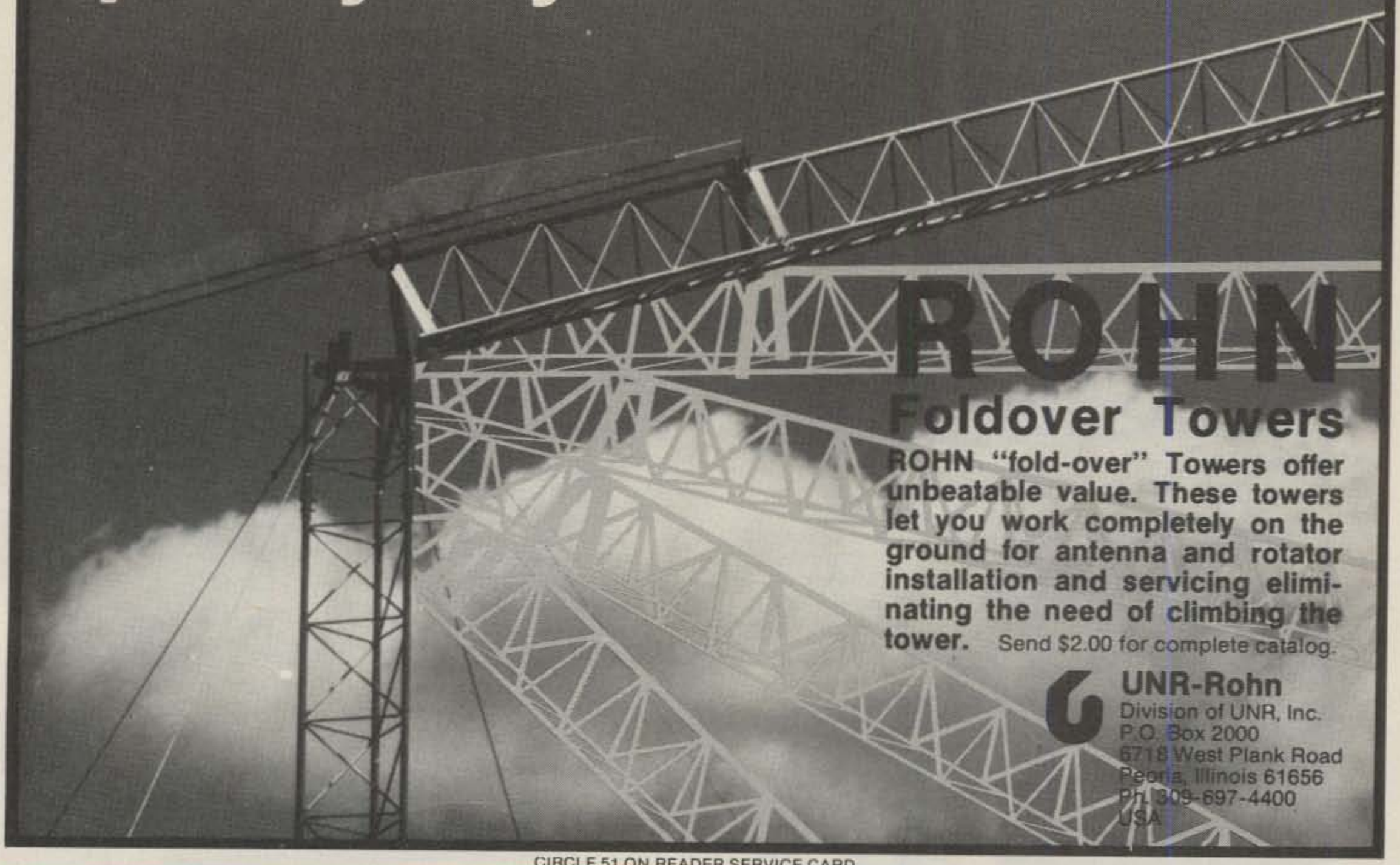
# quality says it all...



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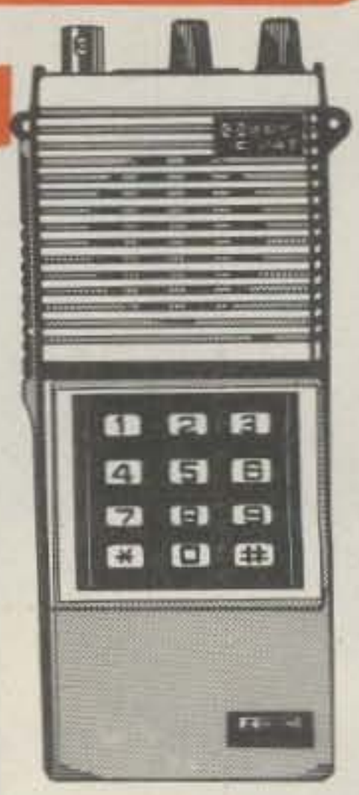

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## MFJ 496 super keyboard

Multi-function keyboard for five mode operation including CW, RTTY, ASCII, memory keyer and Morse code practice. 256 character buffer and 256 character message memory. Also features automatic messages, serial numbering and repeat/delay. Keys grid block, cathode, or solid state rigs. Requires 9-12V DC. Adaptor optional.

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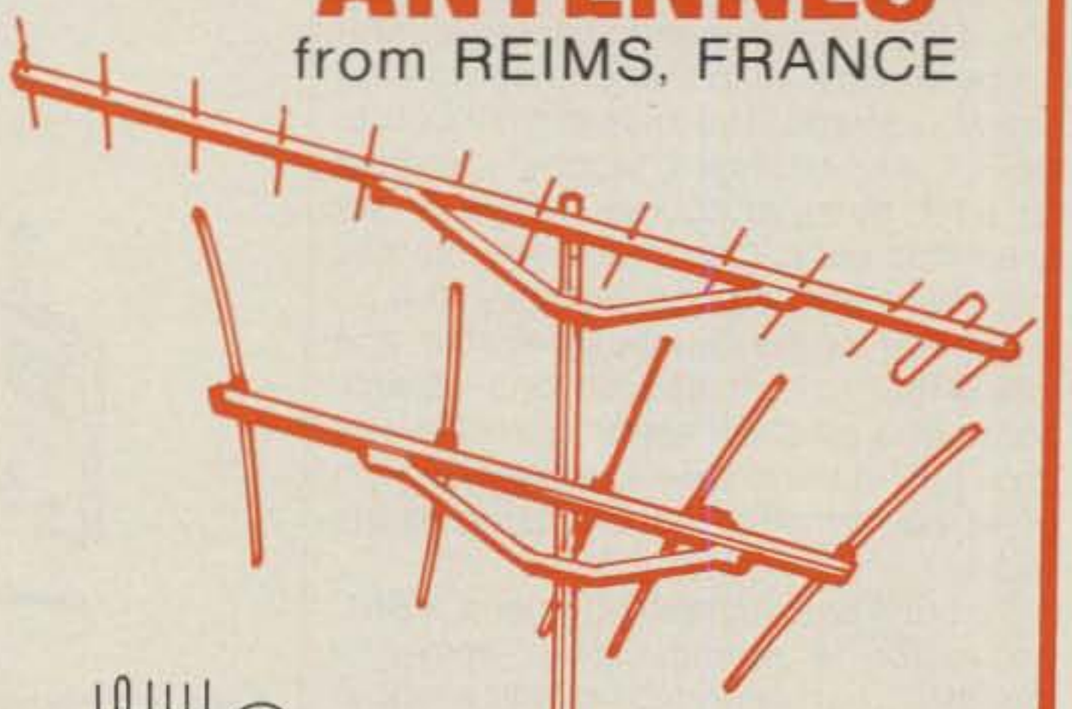

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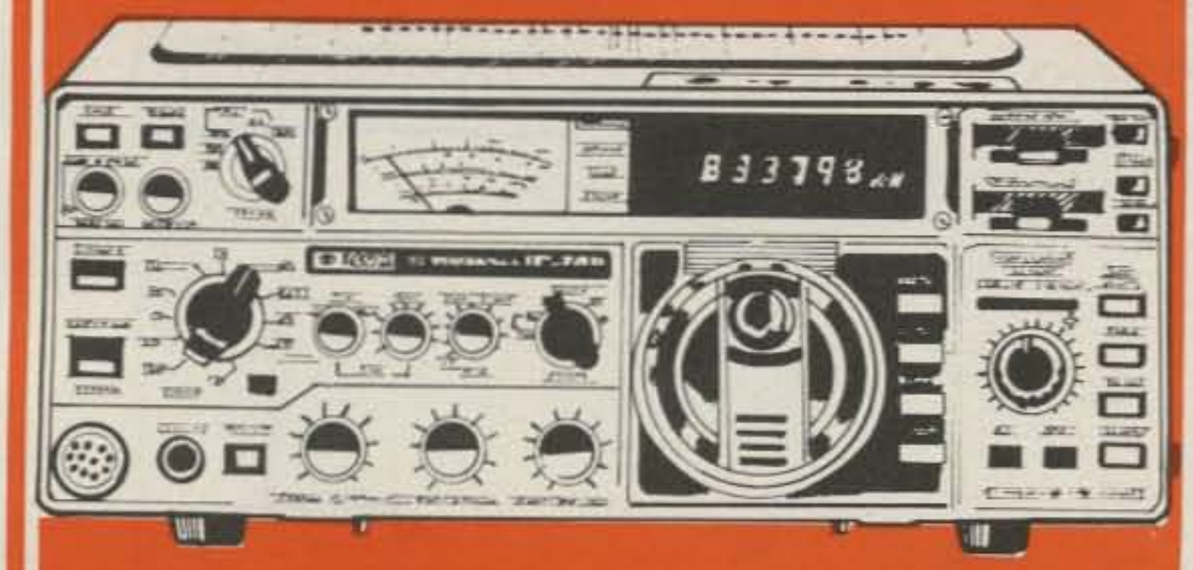

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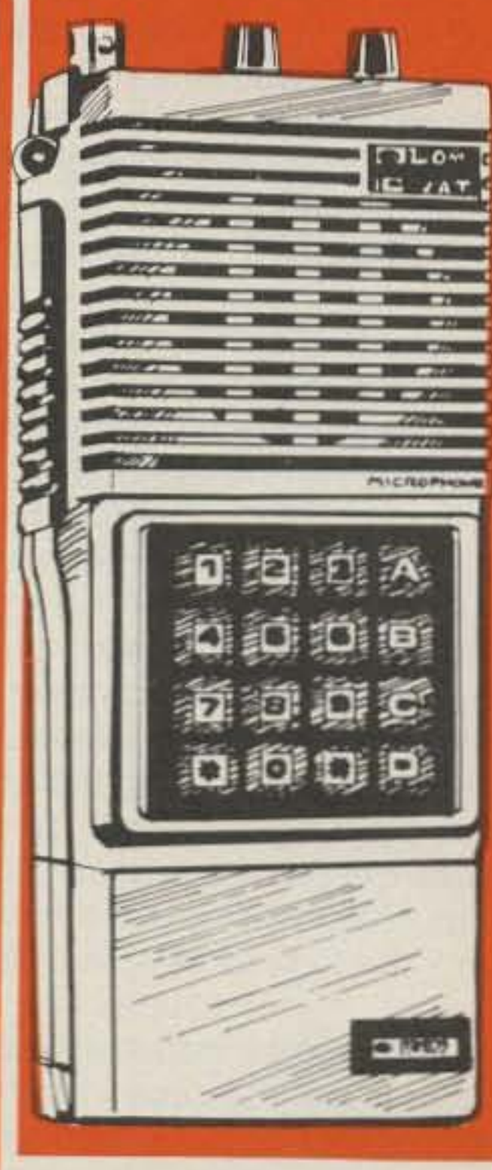

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***If they're rubber ducks on 2 meters, would it be safe to call them rubber ducklings on 450 MHz? WA6NCZ/1 finds out as he rolls his own mini-antenna for his ICOM IC-4AT.***

# A SUPER STUBBY ANTENNA FOR 450 MHZ

**BY RICK FERRANTI*, WA6NCZ/1**

A few months ago when I was finally cajoled into joining the MIT UHF Repeater Association, I decided to purchase a new ICOM IC-4AT. This marvelous jewel of a radio was all I had hoped for, except the antenna didn't suit my needs. I had one of high-tech's finest products, but the floppy, flexible whip that comes with the unit wouldn't do. The answer to this problem? A rubber duck ("stubby" antenna for u.h.f. fans), of course. Where to get one? Not easy. One manufacturer has them with BNC fittings, but they're a bit expensive for the connector, spring, and tubing that you get, and too long, as well. So, in true amateur spirit I homebrewed my u.h.f. rubber duck—a real shorty, with great performance hand-tailored to the radio.

To build one yourself you need a BNC connector, a spring, some epoxy, a length of heat-shrink tubing, and a rubber or vinyl cap for the top. The BNC connector can be any type you can get, but it of course needs the center contact pin. A crimp-type connector with its captive center pin is ideal; just keep the spring-wire from shorting to the connector body with insulation of some kind.

The spring can also be any type. Get one approximately the same diameter as the BNC connector or a little smaller; mine is 5/16 inch in diameter. A good spring source is those old microphone connectors in your junkbox—the ones you used on Heath and Motorola equipment in the 50's. The spring comes from the strain-relief part of the connector. It's about the right diameter and can be stretched slightly so the turns are spaced about one wire diameter apart. That way they won't short to each other. Having done this, or having found another spring somewhere (again, stretched so adjacent turns don't touch; the spring should be 2½–3 inches long), you'll need to straighten out one end and bend this so it points down along the central axis of the coil (see fig. 1). Try to keep your bends kink-free or the spring wire may fracture; I used two needle-nose pliers for this operation. Cut this straightened end to the correct length for your BNC connector, and try the assembly in the radio jack to check for lopsidedness or asymmetry along the antenna axis. A few minutes spent diddling with this will help make the results look professional.

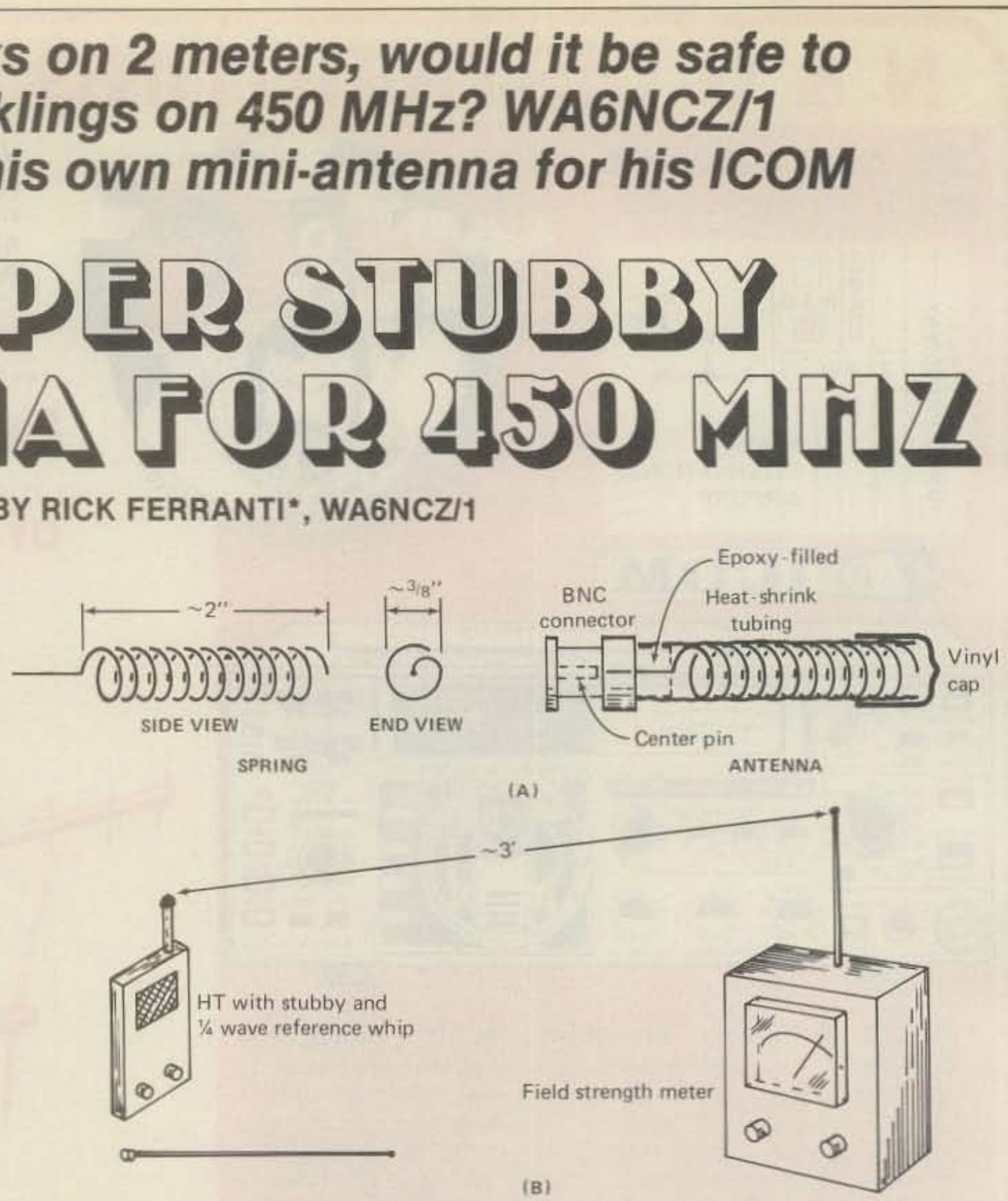


*Fig.1– (A) Simple constructions details for stubby antenna plus tuning procedure (B).*

Now you should remove the assembly from the radio, solder the center pin to the coil, and then epoxy-fill the remainder of the connector to hold the spring upright in place. Be careful not to get epoxy into the movable collar of the BNC or down around the center pin!

Next get your piece of heat-shrink tubing, which should be a little larger than the outside diameter of the BNC connector, and slip it down over the whole assembly until it reaches the collar of the BNC. When you shrink this, it will collapse around the separated turns of the spring to keep them from shorting and will make the antenna more rigid overall. If your piece of heat shrink is big enough to go around the spring but not the BNC, you can stretch the tubing's end slightly by inserting a pair of needle-nose pliers into one end as far as they will go and pulling apart the handles. Then slip the tubing over the antenna and connector and shrink the whole length with a heat gun or blow-dryer. There are two points to note here. First, try to get black tubing, since it looks better than having a red or yellow antenna. Second, I learned (the hard way) that you must have the heat shrink in place to tune the antenna; in fact, the cap must also be in place to check the tuning. At u.h.f. these dielectrics, while not horribly lossy, change the impedance and therefore the tuning of the stubby, since they're in close contact with the radiating element.

Speaking of caps, the ideal cap to use is one like you've seen on 2 meter ducks—a soft, vinyl thing (black, please!) that pushes over the open end of the antenna. Two supplies of these are old 2 meter ducks, or old pocket-scanner antennas (surplus places sometimes have these, or check the junk table at your local Radio Shack). If you have a friend working in the electronics industry, he or she may be able to get the caps from female BNC connectors on packaged amplifiers and mixers; they protect these devices in shipping and are tossed out when the devices are installed in equipment.

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Say You Saw It In CQ

You can also ask at your next ham club meeting. If still no luck, try making one out of plastic tubing or heat shrink with a cover epoxied on one end. The cap should stay put when in place, but it should be removed easily, since you'll have to take it on and off for tuning purposes. Hence, those nice vinyl caps are ideal for a duck.

Now that you've built the antenna, you need to tune it—a relaxed half-hour's work. As it stands now (about 2½–3 inches long), it's way off resonance, so you'll have to prune it a turn at a time with diagonal cutters. This spring wire is tough, so use old heavy-duty cutters for your tuning.

To accomplish this feat, you need your HT, the ¼-wave antenna it came with, your new super duck, and a field strength meter (FSM). Any old FSM will do; those s.w.r. bridges with screw-in field-strength whips work fine. Sometimes your multimeter will respond to the 440 MHz energy if you switch it to a low a.c. voltage or current scale with the leads arranged in a loop. At any rate, set up the meter about 3 feet or so across from you, and key up your HT with its ¼-wave antenna in place. Now adjust the spacing between HT and FSM so that you get about a full-scale reading; you want maximum distance for a usable reading here. By the way, switch to a vacant channel when doing your tuning!

Now put the stubby in place and key up again. The FSM probably will hardly move, so now you've got to take off the antenna, remove the cap, and prune off a turn from the coil. I found it was easier to slice off the heat shrink around the top turn before attacking the beast with diagonal cutters. After cutting off the turn, put the cap back on and try your antenna on the radio again. Slowly, after taking turns off one at a time and keeping yourself and the radio in the same position for each field-strength measurement, you'll see the meter readings rise toward that of the ¼-wave whip. When they're half-scale, take off only ½ turn at a time. You can also switch between the low and high ends of the band (440 and 449 MHz) to see if the antenna's still too long; higher readings at the lower frequency will indicate this condition. Remember to replace that top cap after every pruning. Also remember that a too short antenna can't be lengthened; if you cut too much, you'll have to start all over again.

Finally, your readings should be nearly as high as with the ¼-wave whip and this is with an antenna (excluding connector) only ¾ inch long! I tried for resonance (a broad maximum) at mid-band frequency (445 MHz), and my antenna ended up with eight turns of coil left. Yours may be different depending on the coil dimensions, of course.

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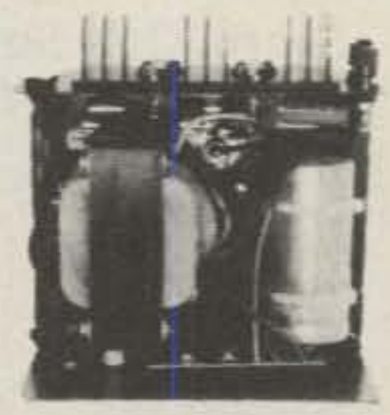

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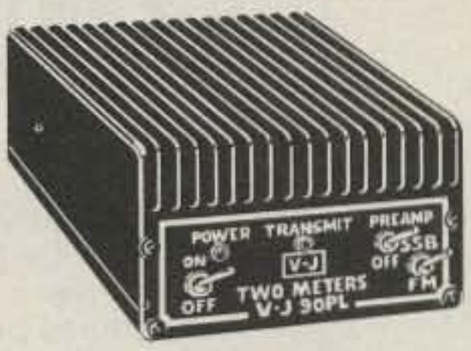


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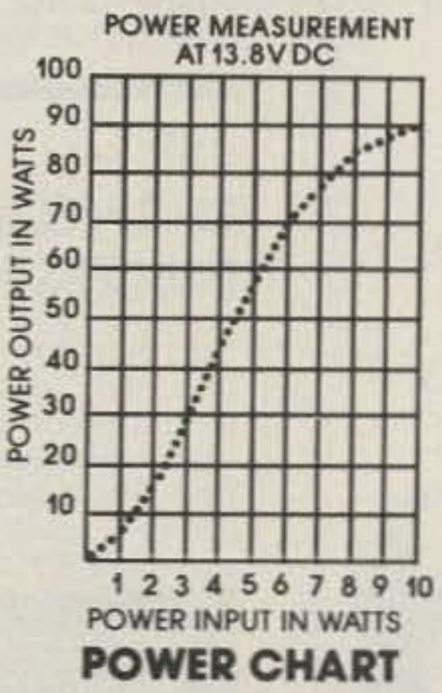


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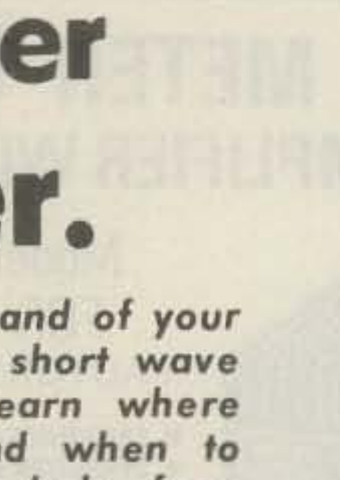

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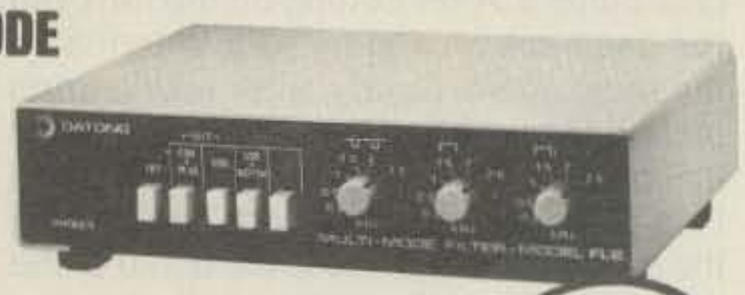

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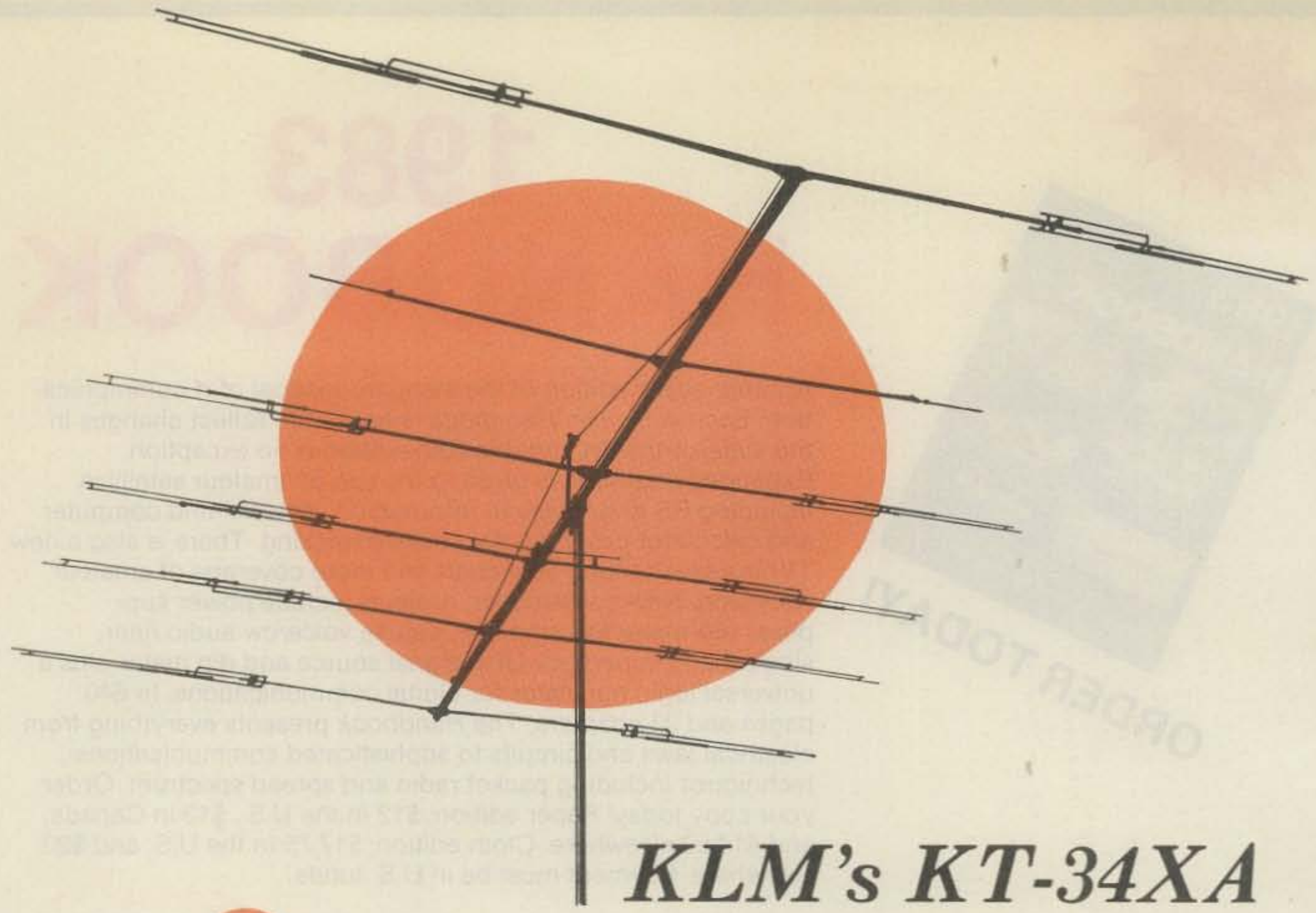

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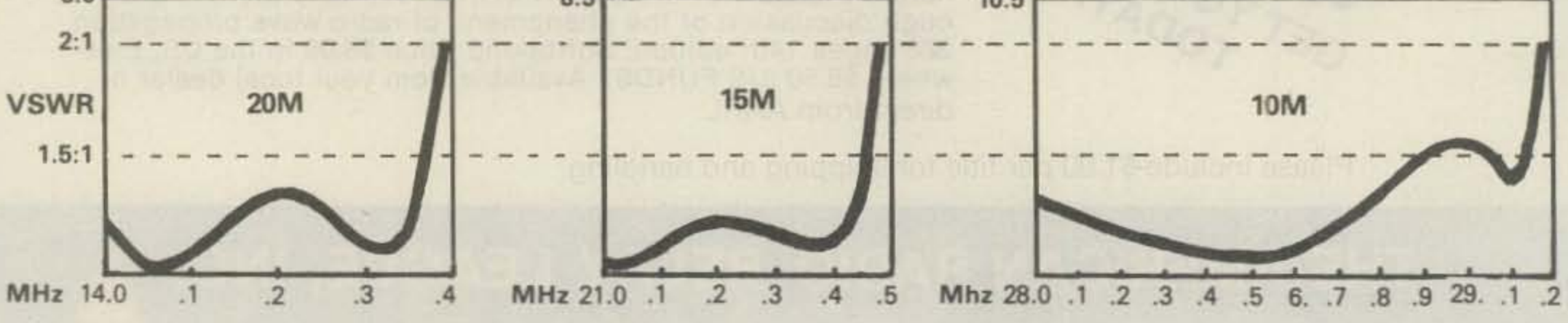
## KT-34XA GAIN vs. VSWR





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***Contrary to some beliefs, the thermionic emission valve, or "tube," is a long way from gasping its last volt. Big bottles can and do run up the price of equipment as well as replacement costs. K4JW shows us how to keep them going for a long time.***

# EXTENDING TRANSMITTING TUBE LIFE

**BY JOHN P. WEBER, JR.*, K4JW**

The purpose of this article is to point out methods of extending the life of transmitting tubes, the cost of which has increased dramatically in the past few years and probably will continue to do so. The two basic methods of extending life are to control the tube filament voltage and to keep the tube envelope (glass or ceramic) cooled properly.

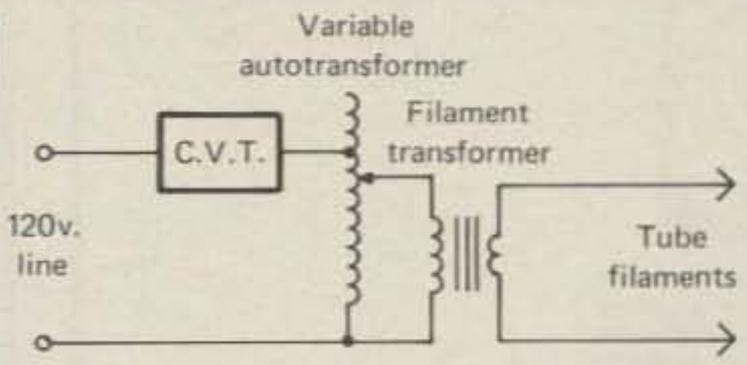
## Filament Voltage

The design life of the tube filament will increase or decrease depending on the applied voltage. For example, increasing the filament voltage 5% above design center will reduce its life to about 48% of its design life—certainly a factor to consider.

If your linear amplifier has a power transformer (combined plate voltage and filament voltage windings), the problem is difficult; you can hope that the transformer designer did his job well. Of course, you can operate the amplifer at its rated input line voltage.

If your amplifier has separate plate and filament transformers, the answer is to control the primary of the filament transformer. A common method is to use a variable-voltage autotransformer (Powerstat or Variac) in the filament transformer primary and a good R.M.S. voltmeter across the secondary. Of course, if we are concerned about 5% changes in voltage, we must have a 1% or 2% full-scale accuracy meter to measure this voltage.

Now, let's distinguish between setting the voltage and then maintaining that voltage. The variable autotransformer will set the filament voltage for a given line voltage. If the line voltage varies, so will the filament voltage; the autotransformer cannot regulate. This brings us to another option: the use of a constant-voltage transformer (SOLA, etc.) either of the step-down variety (made specifically for filament voltage control) or the 1:1 ratio type used before the autotransformer to hold the input constant.




**Variable Autotransformers**
For a total filament power of 360 watts or less:
Powerstat Type 10-B—Superior Electric Co.
Variac Type U-2—Technipower, a Penril Co.
For total filament power of 800 watts or less:
Powerstat Type 21—Superior Electric Co.
Variac Type W-5—Technipower, a Penril Co.

**Constant Voltage Transformers (C.V.T.)**
Sola Type 22-23-125, 250 VA
Sola Type 23-25-175, 800 VA
CPO Type 5AAX-250-8, 250 VA
CPO Type 5AAX-750-8, 750 VA
(CPO = Controlled Power Co., Troy, Michigan)

*Fig. 1– A regulated, adjustable filament supply. It is an inexpensive investment when you consider the replacement cost of high-power tubes. Listed below are some recommended components.*

A true voltage regulator (one that senses output voltage and regulates it to a preset value regardless of load or input voltage changes) could be used, but this becomes quite expensive for amateur use, unless a working surplus unit can be found. Be sure the K.V.A. (power) rating is adequate for your load requirements.

Allied with this problem of controlling the filament voltage is one of limiting **inrush** current to the tube filament. The ratio of the peak inrush current to the RMS operating current is approximately 20 to 1! Please read that last statement again: the ratio of the *peak* inrush to the RMS—it's the *peak* current value that causes mechanical stresses on the filament structure and shortens life. One way to "soften" this inrush is to limit the current with an impedance in series with the filament. Those linears with a single power transformer get some protection because the filter capacitors in the d.c. power supply look like a short-circuit when they are discharged. The surge current they draw reduces the filament voltage at turn-on due to the voltage drop across the primary resistance of the transformer. (Here we go again; hope our friendly transformer designer did a good job of distributing winding resistances when he selected wire sizes.) Of course, if we use the variable-autotransformer method of voltage control, we can start from zero and increase to the rated voltage and eliminate any inrush problem.

While we are on this inrush subject, let's look at the proper way to start up a linear that has just had brand new tubes installed. Turn on the amplifier with rated filament voltage applied to the tubes, but without any plate voltage or input from the exciter. Let the amplifier run for 30 minutes in this mode of operation. Now some of you will ask, how can I turn off the plate voltage? Well, many amplifiers have a "stand-by" switch. Here the answer is obvious: leave it off! Other amplifiers having separate plate and filament transformers have an interlock switch connected to the cover which prevents the plate transformer from being energized, but does energize the filament transformer. In any case, be careful—**Danger, High-Voltage!**

The next thing we want to do is operate the linear at about 50% of rated plate current for 15 minutes. You can put the linear in the "c.w." mode and control the plate current by the drive from the exciter. Then operate at normal "full-bore." You have broken-in the new tube(s). Broadcast stations use this procedure even on older tubes that have been out of service for periods of 90 days or more.

By now, you are asking, "How about lowering the filament voltage? Can I decrease this voltage 5% and double the tube life?" Well, yes and no! If you reduce your power slightly (Oh, that's so hard to do! Remember the mike gain control?) you will probably increase the life dramatically. Ceramic tubes have a unique prob-

*102 Southgate Blvd., Melbourne, FL 32901

lem, however. If a ceramic tube sits in a stand-by mode (filament voltage at rated, cooling system operating), the tube might show decreased output after a period of time because its internal capacitances are changing due to a plating effect attributed to the steep temperature gradient between the filament and the ceramic cylinder forming the insulation between the grid and plate. This will be discussed again under cooling.

As the tube approaches "end-of-life," it can be "rejuvenated" by operating it at about 15% over rated filament voltage with plate voltage off, no drive, and the blower turned off. A time of 15 minutes can be tried first. If the plate current is still high for a given output, try another cycle of 15 minutes.

It is of prime importance to remember that the filament voltage is measured at the tube terminals, not at the socket or back at the transformer. Also, you should periodically inspect the wiring and solder joints; a small amount of resistance can lower the filament voltage.

## Cooling

Probably the most important factor governing satisfactory tube life is its maximum temperature rating. The equipment to make such a temperature measurement is usually beyond the typical amateur's equipment capability. We must assume that the linear amplifier designer has done his job properly and the tube(s) are adequately cooled.

Let's look at the factors the designer has to consider in cooling the linear. He must assume an ambient temperature (how hot is your shack?) for the inlet air; must provide enough air flow (cubic feet per minute, or CFM) for the fan to keep the tube below its critical temperature; must assume an increase in static pressure (the fan works against this) due to dirt build-up at the entrance and exit of the air-flow; must ensure proper air delivery (CFM) of the fan at the lowest voltage it will encounter and still keep the noise level so the guy down the next block won't say, "I can hear your linear's fan noise"; and, of course, must have "zero" noise level in the receive mode so you can pick out that "rare one." An awesome task, indeed! The least we can do is help him (and ourselves) by making sure the intake and exhaust areas are not obstructed. Is your linear located so it is clear of the wall and curtains and is not picking up heat from other gear nearby, and so forth?

When was the last time you vacuumed the dirt out of your linear, your precious ceramic tube? Have you cleaned the surface of the glass or ceramic? Have you wiped off the fan blades?

If you get the impression that routine preventative maintenance in the form of simple housecleaning of your linear is what we're driving at, you're right!

You fellows who live at the higher altitudes (Denver, etc.) require greater air flow than those of us who live slightly above sea level. The correction factor can be as high as 1.3 times the air flow we need to obtain the same cooling. Of course, you can argue that your air is cooler. However, we are dealing with the ambient temperature in our shack. Many linears use axial blade fans that are designed for 120 volt operation, but a resistor is placed in series with the fan to slow it down, primarily to reduce fan noise. This is fine, except when we examine the following relationships. **Air Delivery** (CFM) varies directly with the speed of the fan (RPM). **Static Pressure** and **Total Air Pressure** (resistance to air flow) varies as the square of the fan speed (RPM). It becomes obvious that the air delivery of the fan is then a function of its applied voltage, and when you stick a resistor in series with the fan motor, you could be in trouble!

One method of air-flow control that is used is to cut out this series resistor through use of a thermostatic switch located in the enclosure that senses when the temperature is rising too high and speeds up the fan to cool down the enclosure.

In summary, keep the filament voltage at or slightly below rated, and make sure that the tube is getting adequate cooling. Using a design center life of 1000 operating hours, you might stretch this by 50–100%, a worthwhile savings indeed.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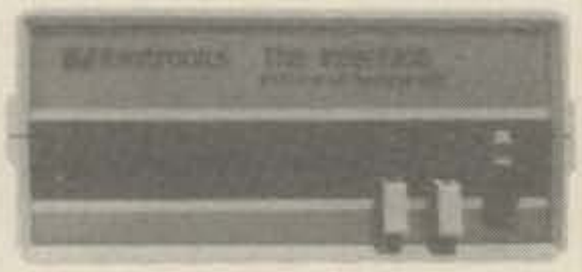

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You won't find as much well thought out programming, circuitry, and features anywhere, at any price! The ATR-6800 combines the best of both worlds, an easy to use video system for CW/RTTY/SSTV with automatic station control **and** a stand-alone computer with expandable memory & full instruction set in Motorola assembly language. Add the BASIC language option package and you'll have the unique combination of an RFI proof computer and ultimate RTTY/CW HAM station. And don't forget "easy to use." All of us at Microlog are RADIO ACTIVE on RTTY, so there's a lot of personal attention to detail and ease of operation. "Stick-on" command listing and video status display will get you on the air quick and sounding like a pro.

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## ATR-6800 vs ACT-1

The most often asked question we hear is "What's the difference between the ATR & the ACT-1?" The ACT-1 is a dedicated system for RTTY/CW/SSTV. It provides all the functions and features you need for a multi-mode station. Along with this superior "ON-the-AIR" performance, the ATR-6800 extends your operation into the realm of automatic station control and computer programming. Plug-in applications modules expand the ATR's memory to add new HAM oriented programs which are enabled by simple keyboard commands. By adding the BASIC option package, you'll have pre-programmed full community mailbox, contest dupe sheet, personal station log, message editor, BASIC computer language and 16k of battery-backed (non-volatile) memory. We also provide a subroutine list so that you can write programs to directly control the ATR-6800 in easy to use BASIC language. The ATR-6800 then is the expandable, "do everything" system where your imagination is the only limit! The ACT-1 is designed for the HAM who needs the essentials of a complete video system for digital communications.

## TECHNICAL SPECIFICATIONS ATR-6800 & ACT-1

**INPUTS**

| | |
|---|---|
| Speaker Audio | 100mv min. |
| Digital | TTL, Keyer, Hand Key |
| **RS232 | ±12V, 330 Ohm Source |

**OUTPUT TO TRANSMITTER FOR CW/RTTY/SSTV**

| | |
|---|---|
| + Voltage Keying | +40VDC @ 300ma Max. |
| – Voltage Keying | -150VDC @ 50ma Max. |
| **Mercury Relay | 200VDC or 2 amp (20VA Max.) N.O. & N.C. |
| T/R Change Over | ATR — Relay ±30V @ 2 amp N.O. & N.C.<br>ACT-1 — Transistor +12VDC @ 300 ma. GND on XMT |
| AFSK Tones, Range | Keyboard Programmable 500 Hz to 3000 Hz |
| AFSK Tones, Level | Mic Compatible 30-50mv Audio |
| Slow Scan | Mic Compatible Audio. Sync 1200 Hz, Black-1500 Hz, White-2300 Hz |

**MISCELLANEOUS CONNECTIONS**

| | |
|---|---|
| RS 232 | ±12VDC, 330 Ohm Source Impedance, Negative Mark |
| Printer Driver | ATR — • Hi-speed RS-232 upto 2400 Baud<br>• Slo-speed Baudot & ASCII Floating Relay for Current Loop Switching<br>ACT-1 — • Slo-speed Baudot & ASCII Transistor Switch +40VDC @ 100 ma.<br>• Optional Hi-speed ASCII RS232 @ 2400 Baud. |
| Tape Recorder "Brag Tape" | Mike = 100 mv Audio<br>Speaker = 200 mv Audio |
| Scope | Horizontal and Vertical Outputs to Scope for RTTY Tuning Aid |
| Morse Speed Tracking | Automatic or Speed Lock |

**VIDEO OUTPUT**

1 Volt Peak to Peak, Negative Sync Composite Video (American Standard) European standard available upon request.

**VIDEO FORMAT**

| | |
|---|---|
| Normal | 24 lines, 40 characters per line |
| Zoom | 12 lines, 20 characters per line |
| Black on White or White on Black | Keyboard selectable |
| Display Split Screen | Any location Line 0 (Off) to Line 20, Keyboard selectable |
| SSTV | 3 lines, 6 characters per line + graphics |

**TEST MESSAGES:** Quick Brown Fox and RYRY's in Baudot, U"U" in ASCII, VVV in Morse.

**SYNC:** Transmits "Blank-Fill" in RTTY and BT in Morse when Text Buffer is empty and unit is in transmit. Keyboard command on/off.

**UN-SHIFT on Space:** Automatically shifts back to "LETTERS" upon receipt or transmission of space. Keyboard command on/off.

**REAL-TIME CLOCK:** Keyboard set, always on screen display, hours, minutes, seconds. Can also be inserted in transmit text buffer by keyboard command.

**WORD WRAP AROUND:** Prevents splitting words at the end of a line. Works in receive as well as transmit.

**CODE PRACTICE:** Random 5 char generator sends at any speed you set via the keyboard. Hand-Key input allows use in code practice oscillator that will also read your sending!

**STATUS DISPLAY** can be called up to show the condition and control commands for 20 programmable parameters, such as AFSK tone freqs, UNOS, printer, etc. Useful as a "HELP" command in case you misplace the manual. There's also a constant "TOP-LINE" display of Time, Mode, Speed, & Code in use.

**DETECTION MODES**

| | |
|---|---|
| Direct | Phase correlation detector with AGC controlled bandpass filter (100 Hz nominal width — 800 Hz center frequency) |
| Demodulator | Computer program enhanced dual tone demod. Primary tones fixed @ 2125/2295 Hz, Secondary tones variable @ 500 — 3000 Hz. |
| **Terminal | RS232 compatible half duplex or full duplex up to 9600 Baud |

**DATA RATES**

| | |
|---|---|
| Morse | 5-199 WPM Keyboard selectable in 1 WPM steps. Auto speed tracking or speed on receive |
| Baudot | All standard 45, 50, 57, 74, 100 Baud (60, 66, 75, 100 and 132 WPM) |
| ASCII | 110 & 300 Baud normal & synclock using internal Modem. ATR adds speeds up to 9600 Baud. |
| Slow Scan | 8 seconds per frame |

**OUTPUT OPERATING MODES**

| | |
|---|---|
| Symbol | Character ouputs when typed |
| Word | Words sent after "Space Bar" |
| Line | Line sent after "Return" |
| Buffer | Send entire contents of text buffer |

**TUNING INDICATORS**

| | |
|---|---|
| Audio Ref. Tone | 800 Hz Keyed Regenerated |
| Visual | LED on Mark (Keydown) |
| Scope | Tuning ellipse for RTTY |

**PROGRAMMABLE MEMORIES**

| | |
|---|---|
| | 10-40 character messages (400 total) or |
| Here is: | *10-80 character messages (800 total) battery backed |
| ID: | 15 characters maximum in standard ID and 17 in RTTY ID |
| WRU: | Up to 15 characters |
| Selective Call: | ATR — 4 memories, up to 15 characters each.<br>ACT-1 — 2 memories for printer on and printer off |

****COMPUTER CAPABILITY**

| | |
|---|---|
| Memory | Standard unit has 4000 bytes of RAM for user program. Basic package adds 16K. |
| Language | Basic or Motorola M6800 |
| Commands | Input; Output; Load; Go with Break Point; or Normal Basic |
| Tape Interface | Store Programs on Audio Cassette |

**POWER**

115 VAC, 60 Hz 60 VA Max, Act-1, 30 VA Max (230 VAC, 50 Hz optional)
12 volt version available
External input for charging expanded battery backed memory. 6-15VDC @ 10 ma. max.

**MECHANICAL**

| | |
|---|---|
| **ATR-6800:** | |
| Size | 14¾"W x 12¼"D x 4"H |
| Weight | 15 lb. |
| **ACT-1:** | |
| Size | 17.8 W x 3H x 9.5D |
| Weight | 7 lb. |
| **ATR-6800 & ACT-1:** | |
| Color | Beige Top, Black Base |
| Material | AL5052 Aluminum Alloy |

*Standard on ATR, Optional on ACT-1
**Standard on ATR, Not available on ACT-1

CIRCLE 12 ON READER SERVICE CARD

**MICROLOG CORPORATION** —18713 Mooney Drive—Gaithersburg, MD 20879 (301)258-8400

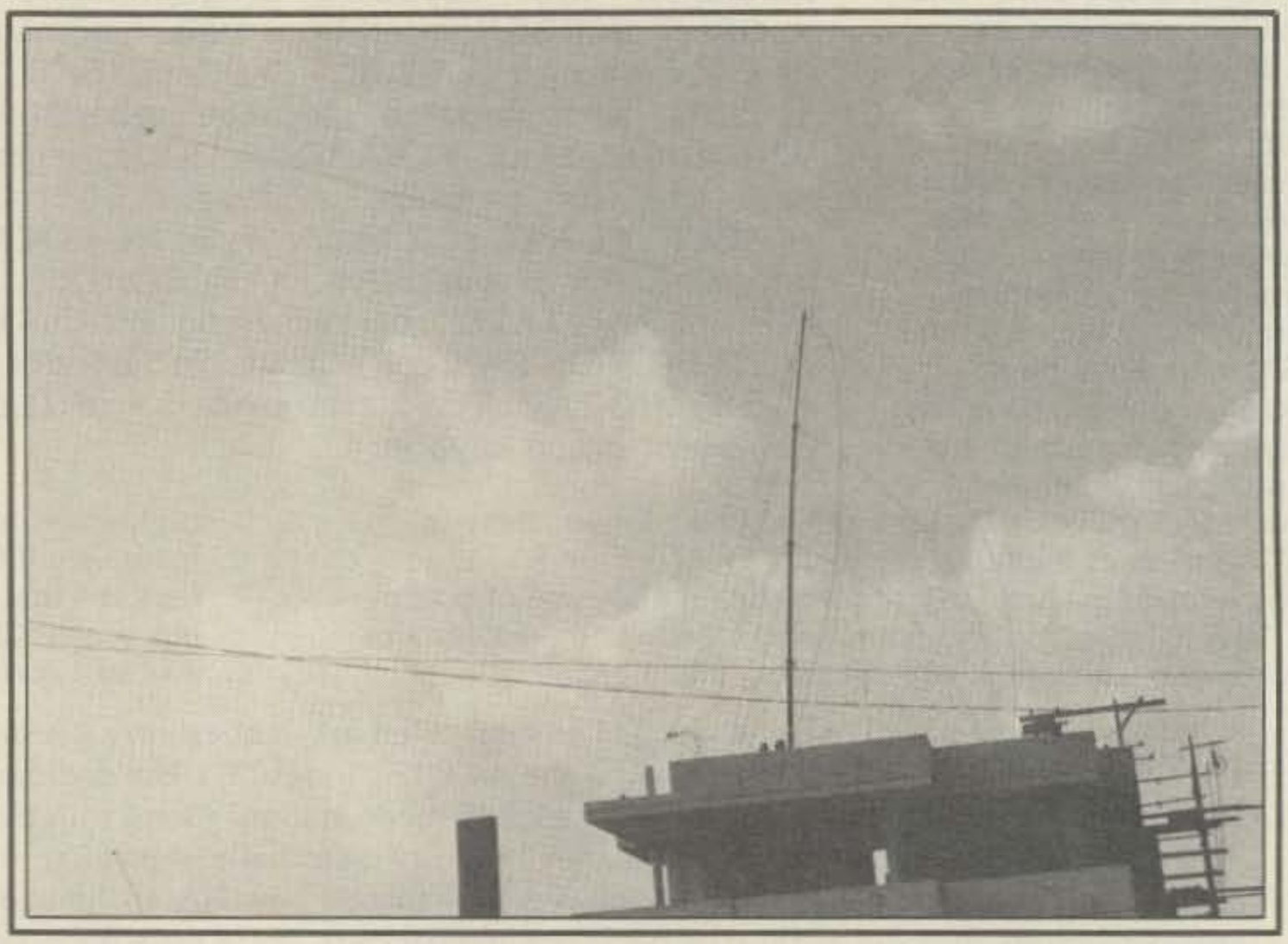
# Results of the 1982 CQ 160 Meter C.W. and Phone DX Contests

BY DONALD McCLENON*, N4IN

Someone may soon make DXCC on 160 in our contest the way things are going. There were 93 countries on c.w. and 67 on phone this year.

Received logs show c.w. participation by 1569 W/VE's, 1272 DX stations, and over 130 extra multi-op operators, for at least 2971 total. On phone there were 1796 W/VE's, 1040 DX stations, and over 47 extra multi-op operators, for 2883 total. These numbers are much larger than the apparent activity, because many stations, especially in Europe, run under 10 watts input and work only a few others at rather close range.

Conditions did not keep pace with activity. The northeast U.S. to Europe path was much tougher than in the past on both modes. Propagation actually favored the southeast U.S. at times. Nobody worked Europe from W9 or W0 on either mode; only 2 W8's did it on phone, 3 on c.w., and only 2 W5's on c.w. The JA's could only get the far western states on c.w. instead of working inland as in previous years.



*Antennas at IR8ONU (Oprs. I8ULL C.W., I8UDB Phone). Wind is bowing the guys, which let go and required complete tower replacement before the Phone contest.*

## C.W. Contest—January

The top 10 W/VE scores are way down from last year, the top 10 multi-ops are slightly down, but the top 10 DX scores are somewhat higher due to the increase in country multipliers.

All states and provinces were on, except NWT/Yukon, but PEI was extremely scarce, with Alaska, Nebraska, and Wyoming missing from most logs. This year's rare-multiplier supplying heroes were: Alaska KL7GIH, KL7JEF; Nebraska W0AP, K0HA; Wyoming W7HLA; N.B. VE1AXT; N.F. VO1HP; P.E.I. VE1BIG; Man. VE4ABE; Alta VE6OU.

W/VE participants worked very few of these choice active prefixes: C3, CR9, DU, EA6, EA9, EL, FC, FG, GJ, GU, HB0, HI, HV, J73, J88, KH3, KL7, LA, LU, OH0, OY, PY, PZ, UA2, UA9, UC, UD, UF, UG, UH, UI, UJ, UL, UM, UN1, UO, UQ, V2, VP2V, VS6, VU, XE, YV, ZD7, ZF, ZL, 4U1, 6O1, 8P6, 9L1, 9V1, 9Y4.

World high score of 525,705 points was made by last year's winner, NP4A, again operated by K1ZM. This is well above his own previous record-breaking score. KV4FZ was again second with 390,235 points, also above his 1981 score. Other 6-figure scores were K3SXA/MM 128,790, EA2OP 116,171, N4WW 110,880, G3RPB 107,590, UK2PCR 106,400, PA0HIP 104,937, and OZ1LO 103,455. Top 10 scores in the W/VE Single Operator, DX Single Operator, and Worldwide Multi-Operator categories are shown in the score boxes.

A new QSO record of 599 was set by NP4A, followed by K5GO 533, N3AMK and N5JJ 509, KV4FZ 496, W0AIH/9 484, W9LT 456, K8US 451, WB4URW 449, N8EA 444. Outside W/VE, besides those shown above, high QSO totals were UK2RDX 395, OZ1LO 365, EA2OP 363, PA0HIP 350, IR8ONU 342, GM3IGW 339, GW3NYY 328, YU3EF 325, OK1MNW 316, LA4O 309. Contact totals of the higher scoring stations outside N.A./EU were well above last year. Leaders were KH6DX 181, JA5DQH 153, 4X4NJ 150, JA7NI 145, UA9MR 122, JA3YBF 111, KP4KK/DU 110, JA9YBA 109, JA2YKA 107, JA1DDH 106.

For the first time a multiplier of over 100 was reached: NP4A's 101. The old record was 90. Following were KV4FZ 85, N4WW 80, W1CF/1 and N4IN 75, N5JJ 74, K5GO 71, G3RBP and W2FJ 70, W3TS and W7XR 68. DX multiplier leaders, other than those shown above, were EA2OP 59, PA0HIP 57, OZ1LO 55, K3SXA/MM and GM3IGW 53, UK2PCR and UK2RDX 50, YU3EF 49, DK6AS 48, GW3NYY and OL6BAB/P 47.

Country worked totals by the leaders were far above any previous records. High in this department were G3RPB and NP4A 51; UK2RDX 48; OZ1LO and UK2PCR 46; PA0HIP 45; LZ1KDP and OL6BAB/P 43; DK6AS, EA2OP, GM3IGW, OK1MMW, OK1KSO, OK1PGF all 42. Europe completely dominates this category with its big increase of available

*3075 Florida Ave., Melbourne, FL 32901



Say You Saw It In CQ

*Part of the crew at LZ1KDP. In this contest, only LZ1GC (far left) and LZ2CJ (fifth from right) ran the station with an s.w.l. assistant.*

*Top European C.W. scorer EA2OP with a wall of trophies from other contests.*

countries. The highest W/VE country totals were N4WW 34, N4IN 30, W1CF/1 29, W2FJ and N5JJ 25, W1BB 24, W1MX 22, AA1K 20.

High W/VE stations in 10-point DX contacts were K3VA/6 71, N4WW 66, W1CF/1 49, K6DDO 47, N4IN and K7XX 45, K6XT 41, N6ND 33, W1MX 30, W2FJ and N5JJ 29. This is way down from last year. High DX stations in making 10-point W/VE contacts were NP4A 445, KV4FZ 424, K3SXA/MM 237, KH6DX 114, HP1XAT 90, W1BIH/PJ2 77, VP8ANT 44, G3RPB 42, VP5SMX 39, EA2OP 32, W6KG/PZ1 28, GM3IGW 27, IR8ONU and PA0HIP 23, YU3EF 22. At least 659 W/VE's worked one or more DX stations, and at least 178 DX stations worked one or more W/VE's.

The following numbers of separate stations were reported active from DX countries having more than 10 entrants: JA 247, G 217, OK 178, UA 99, DL 91, UB 79, OH 26, YU 25, UP 24, UA9/0 22, GM 17, PA 16, F 15, HB 14, UC 14, OE 11.

Some stations put in a lot of extra work to help others get a new country. VP8ANT (G3CWI home call) mounted a dipole 12 feet above rocky ground on a small plateau 500 feet above sea level overlooking the ocean on 3 sides in Antarctica. He dictated his entire log to G3ZAY and G3XTT on the h.f. bands after the contest. They sent it in so it would make this summary. Mail would have been too late.

Both new special-permit Italian stations I0ONU and IR8ONU put up a number of sending and receiving antennas. One big guyed pole went down in a windstorm before the contest, but it was rebuilt in time to participate.

With increased activity, there were many newcomers who did not understand how the DX window is supposed to work. Some of us didn't have big enough signals to explain it to new DX stations, so the window blacked out for a while in the ensuing pileup. Patience and education seems the best course. Most of the volunteer policemen did more harm than good. The Caribbean stations usually kept out of the window, to everyone's benefit. Some voice operation still darkened the window, and very seldom would the s.s.b. boys allow the Russian window to open.

KV4FZ wins the top world score W0AW Memorial Trophy presented by NCCC, since NP4A won it last year and cannot repeat. N4WW wins the West Gulf ARC Plaque for top W/VE score. Highest European scorer EA2OP receives the Plaque for his achievement, also presented by West Gulf ARC. The single and multi-op winner in each state, province, and country will receive the appropriate *CQ* certificate.

## Phone Contest—February

Conditions appeared poorer for most of us than they were for the C.W. contest, but the top 10 W/VE scores were noticeably higher than last year, as were the top multi-ops. The top 10 DX single ops were bunched, with the highest scores lower, but the bottom ones higher. The only state or province missing was North Dakota, which was not claimed in any log received. Very few got Alaska KL7JJH; N.F. VO1IA, VO1HP; P.E.I. VE1ABU, VE1BPY; or Yukon VY1AS, worked by some lucky ones. Except for the following stalwarts, most contestants would have missed their states or provinces, as few others were worked from there: Idaho KA7BTQ, N7SU; Minnesota W0HW; Mississippi WA0DXZ/5, WN5IJZ, W5GWD; Montana K7VIC, W7JYW; Nebraska K0HA; Nevada KA7BRE, K7CA; Oregon W7EJ; Utah N7DF; Vermont K1LPS, AE1T; Wyoming K0WLU/7; N.S. VE1YX; Man. VE4RP; Sask. VE5UF, VE5XU; Alta VE6AQI; B.C. VE7WJ. Here are some of the active prefixes missing from most W/VE logs: C3, DL, EA, EA6, EA8, EA9, EI, F, FG, GD, GI, GM, GU, GW, HB, I, J73, J88, KH3, KP4, KL7, LA, LU, LZ, OA, OE, OH, OK, PA, PY, UA, UA2, UA9, UB, UC, UD, UL, UM, UN, UO, UP, UQ, UR, V2, VK, VK9, VP2M, VP2V, VP8, YU, ZB, ZL, 8P6.

KV4FZ is worldwide high scorer with 278,330 points. Breathing down his neck was VP2E with 275,520, just two QSO's and one multiplier less! They were followed by W8LRL 129,000, W1CF 127,020, HH2B 98,736, WA2SPL 93,600, W7FG 79,632, N3AMK 75,480, N4WW 70,980, K8US 70,224. Top 10 scores are shown in boxes for the same categories used for the C.W. contest.

W8LRL is the QSO leader with 736. He is followed by W1CF 710, WA2SPL 624, W7FG 596, K8US 584, N3AMK 573, WB8JBM 560, WA5WKO 532, UK2PCR 513. Outside W/VE, in addition to UK2PCR, some high QSO totals were KV4FZ 448, VP2E 446, UK2RDX 432, OK1KSO 221, HH2B 214. Outside N.A./EU we have KH6KV 83, YV3AZC 80, VK3BEE 22, UA9MR 21.

The high multiplier department was led by W8LRL with 75, just 2 less than last year's top. He was followed by W1CF 73; KV4FZ, WA2SPL, N4WW all 65; VP2E 64; W7FG 63; N4IN, N7DF, W9UP all 62; K8MN 61; N3AMK and WA5WKO 60. DX station multiplier leaders not shown above were HH2B 48, YV3AZC 41, OK1KSO 40, K3SXA/MM 39, IR8ONU 36, LZ1KDP 35, KH6KV 31, G3LNG 29, G3XTT 28, GW4IOI 27.

OK1KSO worked 32 countries to beat last year's top of 30, reached this year by LZ1KDP. They were followed by IR8ONU 29; G3XTT 28; G3LNG, GW4IOI, YU7JDE 26; UK2RDX 25; W1CF, W8LRL 22; KV4FZ, OH2BNP, UB5FDF 21; VP2E, UB5PBA, UK2PCR 20. Europe dominates this category as it did on c.w. Some high W/VE's other than these shown above were WA2SPL 18; N4IN and N4WW 17; AA4MM and K8CFU 14; W2FJ and K2BQ 13; VE1YX, N3AMK, K8MN 12.

The W/VE 10-point contact leader was W1CF with 40. Then followed W8LRL 31; WA2SPL 24; N4WW 22; N4IN 19; AA4MM 17; K2BQ, W2FJ, N3AMK 14. Last year's top was 29. DX station leaders in 10-pointers were VP2E 417, KV4FZ 412, HH2B 198, K3SXA/MM 121, KH6KV 79, YV3AZC 71, XE1HHA 35, IR8ONU 29, HI8DAF 27, ZF1EJ 27, HI8VMA 22, OK1KSO 19, LZ1KDP 12.

The following numbers of DX stations were reported active from countries having more than 8 entrants: UB5 301, UA 291, G 161, GW 27, VK 20, UC 19, UA9/0 18, DL 16, OK 15, PA 12, UP 11, YU 11, OH 8.

We still have no sponsor for a world high phone score trophy. Any volunteers please contact W1WY. As noted in Frank's column in June 82 *CQ*, Don Busick, K5AAD, of West Gulf A.R.C. is donat-

*How's this for a sky hook? The sloper at KH6DX was attached 100 feet up. He worked multi-op with KH6KV, using the latter call on phone.*

ing a Plaque for top W/VE single operator phone and top European single operator phone for this 1982 contest. These will go to W8LRL and IR8ONU operated by I8UDB, respectively. State, province, and country winners will receive certificates as for the c.w. contest.

## Both Contests

There are some operators who are either very poor at copying calls or who have good imaginations, because quite a number of non-participating calls appeared in the submitted logs. We try to be understanding about some of this, but there are limits after which score shrinkage or penalties must be imposed. Some claimed to have worked one or more of the active DX stations, but these did not appear in their logs. Make sure you work someone before logging him!

Fifty-six different clubs were represented, with aggregate scores for both contests shown for each. The highest scoring member is shown for each mode when there was activity on both. Northern Ohio A.R.S. got their members out in force and barely squeaked by Potomac Valley R.C. for first place. One more modest score for PVRC or one less for NOARS could have reversed their positions. Third place goes to the Kuanas Lithuania club with an outstanding group effort. Other six-figure scores are YCCC, Central Florida DX Club, Tallinn Estonia R.C., So. Calif. DX Club, and Texas DX Assoc.

The present contest rules give too big an advantage to being just outside the U.S. We have received a number of DX complaints on this situation. The Europeans feel they should get more points for working Japan than for working another European, for example. To improve matters, the rules will be changed for the 1983 contests as follows:

(1) Each contact with your own country counts 2 points.

(2) Each contact with another country in your continent counts 5 points.

(3) Each contact with another continent counts 10 points.

(4) A multiplier of 1 is earned for each country, Canadian province, and U.S. state worked, but neither U.S.A. nor Canada is a multiplier.

(5) Maritime mobiles in different regions count as countries.

(6) Score is total points times multiplier.

The net result of this will be a slight drop in W/VE scores, a small rise in DX scores, and a considerable drop in Caribbean scores. It does not remove all inequities, but to completely do so would require even more complicated scoring. It is at least a step in the right direction.

The sunspots are starting to improve 160 meter conditions, activity is increasing, and you can still make station improvements before the next running of the c.w. contest the last full weekend of January 1983 (Jan. 28, 29, 30), and the phone contest the last full weekend of February (Feb. 25, 26, 27). Send an s.a.s.e to *CQ* magazine with enough postage for the number of log and summary sheets you hope to use. Take some photos of your station and share them with the rest of us.

73, Don, N4IN

## Aggregate C.W. and Phone Club Scores

| Total Score | Club Name | C.W. | Phone |
|---|---|---|---|
| 462,168 | Northern Ohio A.R.S. | K8US | K8US |
| 434,526 | Potomac Valley R.C. | W3GG | W8LRL |
| 250,037 | Kaunas Polytech. Inst. R.C. | UK2PCR | UK2PCR |
| 233,556 | Yankee Clipper Contest Club | W1CF/1 | WA2SPL |
| 224,432 | Central Fla DX Club | N4WW | N4WW |
| 153,550 | Tallinn Radio Club | UK2RDX | UK2RDX |
| 149,583 | Southern Cal DX Club | K3VA/6 | — |
| 143,700 | Texas DX Soc. | N5JJ | — |
| 98,168 | Radioclub Chomutov | OK1KSO | OK1KSO |
| 83,368 | City Student's R.C., Sofia | LZ1KDP | LZ1KDP |
| 76,048 | Dayton A.R.A. | W8IMZ | W8IMZ |
| 72,830 | Ill Wind Contest Club | KK9A | KK9A |
| 72,800 | MIT Radio Soc. | W1MX | — |
| 69,278 | Central Va Contest Club | WB4URW | — |
| 69,120 | Central Ark DX Club | — | WA5WKO |
| 65,458 | YU DX Club | YU7BCD | — |
| 62,496 | Fort Wayne R.C. | W9LT | — |
| 61,876 | Utah DX Assoc. | — | N7DF |
| 59,898 | Central Ariz DX Assoc. | WB7FDQ | WB7FDQ |
| 58,892 | Radioklub Senta | YU7JDE | YU7JDE |
| 50,886 | Oslo Soc. of NRRL | LA4O | — |
| 49,648 | Kankakee Area Radio Soc. | — | W9AZ |
| 46,004 | Louisville A.R. Trans. Soc. | — | W4CN |
| 43,244 | Rubber Circle Contest Club | W7TJ | — |
| 42,224 | North Texas Contest Club | — | N5JB |
| 41,595 | Murgas A.R.C. | K3YTL | K3YTL |
| 35,261 | Radioklub Ceskomalinska | OK1KZD | — |
| 33,580 | W/K A.R.C., Milwaukee | WA9TZE | WA9TZE |
| 33,500 | Good Buddy R.C. | NM4A | — |
| 32,092 | Frankford R.C. | K2FL | K3FN |
| 31,008 | Adrian A.R.C. | — | KB8HW |
| 27,300 | Holiday Renegades | — | WB4TVQ |
| 26,268 | Radioclub Iskra | OK3KAP | — |
| 25,484 | Milford A.R.C. | W8SDL | — |
| 20,496 | Lakeway A.R.C. | — | WD4PRQ |
| 13,501 | Radioclub Tiba | OK1KPX | — |
| 13,128 | Radioclub OK1KUA | OK1KUA | — |
| 10,296 | Radioclub OK1KRQ | OK1KRQ | — |
| 9,670 | Ohio Valley A.R.C. | KC8JH | KC8JH |
| 9,096 | Canton Radio Club | W8IM | W8IM |
| 8,432 | Ventura County A.R.C. | N6VR | — |
| 8,208 | Radioklub Rokycany | OK1KRY | — |
| 7,936 | Fraser Valley DX Club | — | VE7WJ |
| 7,564 | Northern Cal DX Club | W6BIP | — |
| 7,398 | Radioklub Tesla | OK1KPA | — |
| 7,218 | Radioclub OK2KYZ | OK2KYZ | — |
| 6,336 | Sheboygan County DX Assoc. | KE9A | — |
| 5,593 | Radioclub Stochov | OK1KYS | — |
| 5,292 | Radioclub Zeliv | OK1KZW | — |
| 4,634 | Kanazawa Univ. A.R.C. | JA9YBA | — |
| 3,944 | Radioklub Svazarmu | — | OK1KCU/P |
| 3,179 | Osaka Electro. Comm. Univ. R.C. | JA3YBF | — |
| 1,939 | Nagoya Univ. R.C. | JA2YKA | — |
| 1,680 | Radioklub ZPA | OK1KMP | — |
| 215 | Radioclub OK1KTW | OK1KTW | — |
| 86 | Sanada Rokumon Sen Club | JA0YJA | — |

## Soapbox DX C.W.

I hereby declare that I enjoyed the contest very much and will take part in it next year also—*YU2UE*. Very good contest, good conditions, and many countries—*OK1KPU*. Received special 160 meter operating permit for this contest. Condx poor to US, but incredible JA signals—*IØONU*. My second time in this contest. Got 5 new countries and had a great time—*OZ1LO*. Biggest thrill was working VU2WTR, JA2GQO, VS6DO, in order—*G3RPB*. First year for LZ on 160. Very pleased to work all continents and VP8ANT. Very poor to USA. Will consider Beverages next year—*LZ1KDP*. Worst DX conditions since 1972, but still got lots of new ones—*OK1MMW*. Seven new ones makes 63 countries on top band—*UK2RDX*. Too many DX stations don't listen for us above 1850—*UK2PRC*. Due to high noise level, and overload from another service, could not hear any US stations—*CR9BH*.

Great, as ever, but too much QRN here—*LU1DZ*. Conditions to the States can only be described as appalling—*G3VRW*. Observed total disregard for use of window with DX stations encouraging W/VE's to work them there, jamming the window—*K3SXA/MM*. Condx



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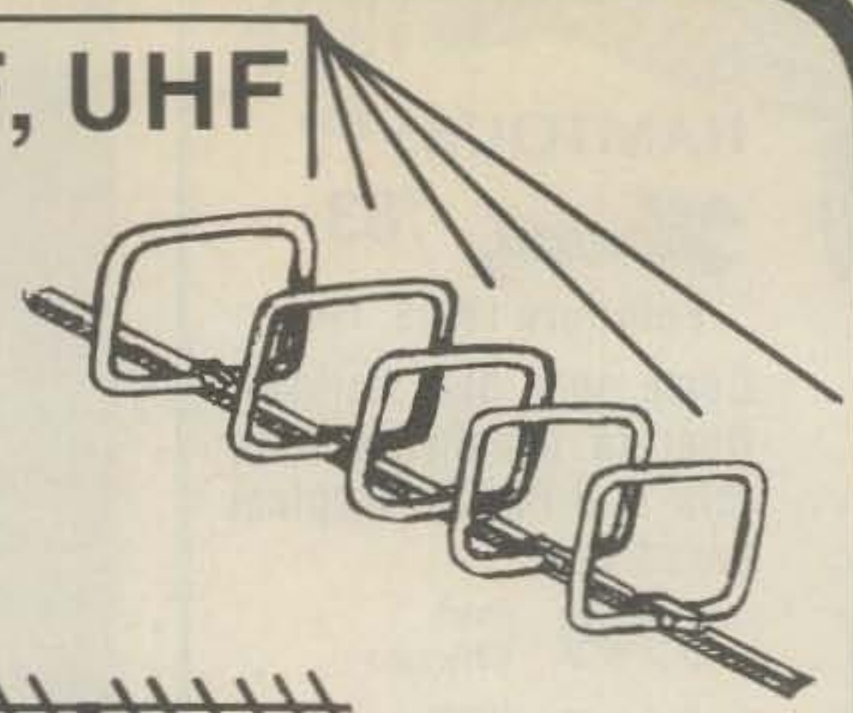

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*This is about as exotic as you can get. CR9BH at Macau with operators OH2BH (left), JA1BK (right), and JA1MIN (center).*

better than last year. If operation permits, will be on from CT2 for next two years. Will be nice to have "local" QSO's. Here only 2 of 110 QSO's were less than 2000 miles away!—*KP4KK/DU2*. Strongest ever heard EU second night. New receiving antennas a big help. A thrill to work ZS7BW, 9L1SL, EL2AV—*NP4A*. Come on guys, 5 points for JA's is no fun at all if OK's count the same. How about some changes?—*YU7BCD*. Very good activity in EU. First night condx to US really poor, but improved second night, even tho QRN—*DK6AS*. Worked VP8ANT, but not a single stateside station—*G3XTT*. Just got my license the day before the contest. Enjoyed it a lot—*OH2BVI*.

Although conditions were only fair, the additional power and improved receiver selectivity had a big effect on the score—*4X4NJ*. DX condx very bad. Hope it improves next year—*DF3LP*. Being so far north makes it difficult—*OH6NG*. Want a challenge? Try 160 with a megawatt giant 600 yards from you on 1593 kHz!—*DK4TA*. Hope for better conditions next year—*EI9J*. Our problem is hearing weak signals—*YU4FRS*. Pleased to work N4IN for first US contact. Our permit is only temporary; do not think Italy will be regularly on 160 in the near future—*IR8ONU*.

Bad condx to USA; only W6 & W7—*JA5DQH*. Final blew in middle of Sat. evening—*HP1XAT*. Stop giving 10 points for W/VE. We EU's haven't got a chance against guys like NP4A and KV4FZ—*PAØHIP*. I am a beginner on top band, and this contest perked up my ham life—*JA1KXT*. Very happy to work in this fine contest. Thank you—*UP2BIO*. Conditions good again after many years—*OH2BO*. Hope to have more activity and better antennas next year—*OY7ML*.

## Soapbox W/VE C.W.

Thrilled to work VK6HD just before I had to shut down so the B.C. station whose antenna I was using could go on the air—*WB4URW*. Several radials ran thru house and garage. These proved hazardous to navigation in early morning hours. Lightning flashes also proved distracting to the operators—*W7FG*. My best score in 5 years. Excellent JA run Sunday morning. Now up to 94 countries—K3VA/6. I'm so imprinted with this contest that I can't imagine being anywhere else on the last weekend of January, so see you next year—*W7XZ*. Called it quits early Sunday morning when I caught myself turning the rotor control on my tribander to peak up the European signals!—*W1WY*. We may not have the biggest score, but we sure had a lot of fun—*K3YTL*. Wonderful how VP8ANT covered all of North America with such a big signal—*W1BB*.

Many stations out of their call-indicated area; guess the FCC strikes again—*AD6D*. Computer sure great for dupe checking—*WØAIH/9*. Another great *CQ* 160 contest, the grand-daddy of them all—*K8US*. Bad weather and very high static just like last year—*WAØTKJ*. Half sloper coax outer connection broke at top of tower. Whatever this is now was my antenna—*W1PL*. The KW stations were out in force. Tough competition and always a real challenge—*W4YE*. For excitement, a burning log fell out of the fireplace at 2 am, but there was no damage—*K5EJA*. Could have used lots less aurora—*VE3PCA*. Snow and static all weekend warped my membranes. I know better, so why do I persist in doing this every year?—*K5JZN*. Thrill being called by 4U1UN and to receive his #1—*W1CF/1*.

Good contest as usual. Too bad the northern sky was green again—*VE6OU*. First time on 160. Surprised at how many states I could work—*KA8JRI*. Lots of new and old-time lids in window—*K9IFO*. Condx much worse than last year, but more fun from my new rare state, Del.—*AA1K*. Less QSO's this year with KW than last year with 50 watts—*KC8P*. Poor condx made this one very frustrating—*VE1AXT*. Rig broke down after 120 QSO's—*W3AJS*. Guess I worked a lot of old contest friends, but with those new calls, who knows?—*KØJPL*. Very nice to have VP8ANT call us; even wanted an s.s.b. QSO—*N5JJ*. Swamp buggy nearly ran down Beverage at 3 a.m. Sun.—*N4BP*.

Exciting to have VK6HD call us for his first QSO—*W7XR*. Noisy snow storms always seem to occur during 160 meter contests—*KK9A*. I think it's easier to recopy and dupe manually than to use a "TRASH-80", hi!—*W3ESU/4*. Serial numbers mixed up due to peculiarities of the keyer and exhaustion of the operator—*K6XT*. Two of our operators were new to 160 and couldn't believe the activity and signal strengths—*K4CNW*. With 12 more dB and low QRN we could have worked the other 20 countries we heard—*KG7D*. Vigilantes in window caused me more problems than the interlopers did—*W2FJ*. Saddest part was the crusty old s.s.b. operators insisting on using 1830—*N4ARO*. Funny that sigs no stronger with KW now legal—*N7SU*.

First time on this band; had a blast—*WA4SVO*. DX condx El Stinko. Glad to get some Caribbeans thru west coast KW's—*KA7BTQ*. Many stations increased power from last year, but their receiving didn't keep pace—*W8IM*. Great conditions: ice storms, high winds, high noise level, power outage—*W8IMZ*. Sure wish I could hear well—*W9LT*. Enjoyed my first 160 meter contest. Thanks for having it—*K8XX*. As always a great contest—*W4TMR*. My little Ranger didn't stir up much of a commotion on the band—*W4KFC*. Weather so bad we were snowed in until 10 a.m. Monday—*KS8S*.

## Soapbox DX Phone

The day before Phone contest, antenna support tower came down in wind. Went to Rome, bought another tower. Got it up with 4 hours to spare for nap before contest started—*IR8ONU*. Never worked USA before on 160 phone. I'll bet Marconi didn't get a bigger kick than I did hearing them come up out of the noise!—*G3LNG*. Thanks for a nice contest. Hope we do better next year—*LZ1KDP*. Amplifier blew up twice during contest. Had to run barefoot second night—*VP2E*. Thanks to the many stations who gave us a point and wished us well in the contest; the most enjoyable one so far—*GW4IOI*. I heard many W/VE stations who couldn't copy me. Much QRM—*YV3AZC*. Thanks for nice contest—*RQ2GGI*. Doesn't compare with the C.W. contest as far as Europe is concerned—*G3XTT*. Very poor condx all the time. Hope better next year—*LU9EIE*.

## Soapbox W/VE Phone

Contest bug hit me my first time. Look forward to many more—*N8BIC*. Never knew how busy 160 could get—*WB9LSR*. We were lucky in both the C.W. and Phone contests to have a good European run during one of the nights. Used two slopers on 200-foot tower plus two reversible Beverages. It takes a long drive, a 45-min. boat trip, and a short drive to get to the station. Once there, the operators make the difference—*W1CF*. Impressed by very courteous behavior of the many operators. Real challenge running 60 watts to 26 ft. vertical. This should encourage participation by small-lot owners—*W4HVU*. QRN first night; much better second. Glad I could put in full effort this year—*KC8P*. Tremendous reports from our 260-foot vertical, but it was noisy on reception. Worked YV3 using audio fed in by phone line from K9IFO. Will have our "ears" in better order for next season—*W9AZ*.

Put up antenna a few days before contest. Had a great time. Will string more wire next year—*VE3KYT*. Learned a lot our first time on 160. Will be ready for it next year—*WB4TVQ*. Line noise, static crashes, ice on antenna (impossible in S.C.?) caused high s.w.r. Still had fun and CU next year—*K4CNW*. Fantastic EU signals second night. Wished there were more

## Top 10 Scores

| Top 10 W/VE Single Op C.W. | | Top 10 W/VE Single Op Phone | |
|---|---|---|---|
| N4WW | 110,880 | W8LRL | 129,000 |
| W1CF/1 (N1EE Op.) | 92,550 | W1CF (WB3GCG Op.) | 127,020 |
| K5GO | 86,478 | WA2SPL | 93,600 |
| K3VA/6 | 80,724 | W7FG | 79,632 |
| N4IN | 74,550 | N3AMK | 75,480 |
| WB4URW | 69,278 | N4WW | 70,980 |
| N3AMK | 68,442 | K8US | 70,224 |
| W2FJ | 63,140 | WB8JBM | 69,600 |
| W9LT | 62,496 | N7DF | 61,876 |
| AA1K | 59,136 | W9UP | 61,256 |
| **Top 10 DX Single Op C.W.** | | **Top 10 DX Single Op Phone** | |
| NP4A (K1ZM Op.) | 525,705 | KV4FZ | 278,330 |
| KV4FZ | 390,235 | HH2B | 98,736 |
| K3SXA/MM | 128,790 | K3SXA/MM | 48,360 |
| EA2OP | 116,171 | IR8ONU (I8UDB Op.) | 36,900 |
| PAØHIP | 104,937 | YV3AZC | 30,832 |
| OZ1LO | 103,455 | GW4IOI (GW8TVX Op.) | 20,790 |
| YU3EF | 82,957 | G3XTT | 11,200 |
| GW3NYY | 79,759 | G3LNG | 10,469 |
| IR8ONU | 78,346 | XE1HHA | 6,745 |
| YU7BCD (YU7AD Op.) | 65,458 | ZF1EJ | 6,670 |
| **Top 10 Multi-Op C.W.** | | **Top 10 Multi-Op Phone** | |
| G3RPB | 107,590 | VP2E | 275,520 |
| UK2PCR | 106,400 | WA5WKO | 69,120 |
| UK2RDX | 99,700 | WB8PAT | 54,696 |
| GM3IGW | 95,877 | UK2RDX | 53,850 |
| N5JJ | 92,500 | UK2PCR | 50,880 |
| W1MX | 72,800 | W9AZ | 49,648 |
| W3TS | 68,408 | W8IMZ | 47,824 |
| K7XX | 65,472 | OK1KSO | 47,040 |
| WØAIH/9 | 64,852 | W4CN | 46,004 |
| N8EA | 62,000 | KK9A | 36,570 |

*Italian multi-op I0ONU. Operators I0JX (left) and I0MGM (right). Italy issued special permits just for our contest.*

of them—*N4IN*. Next year think I'll go on a DXpedition to North Dakota!—*K0GVB*. Won R.I. last time by accident, so stayed up all night for first time trying harder this year—*AD1P*. Nice to work W1WY, N4IN, W8IMZ during contest and thank *CQ* staff for sponsoring this contest. We need an expedition to Wyoming—*K3IXD*. Enjoyed every minute of it—*W1BB*.

Difficult to hear European s.s.b. DX thru stateside QRM, especially in the Russian window. Next time will tape cases where a high-scoring station gets relay help from others and has them hold his freq while he chases multipliers—*WA2SPL*. With 8 receiving antennas, still can't hear the weak ones. Next year will try the clothesline—*KC4OV*. Spent more time checking dupes after the contest than during it—*W8LRL*. Noisy condx this year. It would have been a total loss without the Beverages laid on the snow—*W9UP*. First time on phone, great contest—*WA4SVO*. Antenna experimenting and Beverages helped a lot—*K8CFU*. My very first effort. Catching KH6KV was great fun. Need more antennas and an amplifier—*N4AYO*.

Wall-to-wall geomagnetic disturbances all season. Hope we'll see much better conditions when sunspot decline finally sets in—*K1LPS*. Thrill working my first contest and getting OK1KSO and IR8ONU on first call—*AA4MM*. Too bad condx so lousy—*N7SU*. Missed first 5 hours due to work. Enjoyed it, and will plug more next year—*N4WW*. First night could only hear the very loud stations. Next night a little better. We frequently get this effect up here on all bands—*W0HW*. Nice to hear we had a big signal, but sad we were told of many calling that we couldn't hear—*WA5WKO*.

Train cut my Beverage, and filter capacitors blew up in my amplifier—*KK9A*. No W6 stations. Sad, sad!—*K1NBN*. Tough to work 160 from a city lot with no Beverages—*WA0TKJ*. Was just going to operate casually, but got drawn into it—*N5JB*. Not much of a contester, but very satisfied considering only ran 100 W. Next year maybe more—*KA0HIG*. Amazing how many stations are no louder now that linears are legal—*N7DF*. First phone contest ever entered on 160. CU next year—*WA9TZE*. Voice lasted only 93 QSO's—*K8HF*. Got into contest for the heck of it. Hope I won, hi! (He did, for Colo.)—*K0UK*. Thanks to all who worked so hard getting their info thru my inadequate ears—*WB8JBM*.

### C.W. Multi-Op Station Crews

**W1MX:** AC8P, AE9Y, K1MK, KA1R, N2ME. **N1DM** & KA1AIR, N1RI, WB1FDY. **K2GBH** & KB2YC, WB2KMY. **W3TS** & W30G. **K3YTL:** K3MWA, WA3YON, WB3BVF, WB3CAI, WB3FAA, WB3FYT. **N4KG** & KU4J. **N4BP** & N4UM. **W4CN:** KC4WQ, KD4U, N4XM, NM4K, NO4R. **NM4A** & KA4WNO, N4DBR, NV4H, WA4SRF, WB4ZBX, WB8NWQ. **W3ESU/4** & others. **K4CNW** & K4AVU, KX4H. **N4ARO** & KY4L. **N4DJ** & N4BQN, W4HBK, W4PRO. **W7FG** & AC5P, KM5H, WB5YYZ. **N5JJ** & KG5U, KN5H, K5WA, N5CDO, WB5WHR. **N5DU** & K5LZO. **K5EJA** & K5SOR. **WB6EGE:** KB6HT, N6QC, WB6WPO. **K7XX** & K7SS, KC7V. **KG7D** & K7LXC. **N8EA** & K8GM. **KS8S** & AD8P, KN8S, W8FN. **W8SDL** & AC8M, AE8J, N8AOL, W8USM, WB8RRR, WB8ZJY. **W0AIH/9** & KM0O, K0FVF. **W7XR** & K7CW. **K0KE** & KG0A. **VE3BGA/2** & VE3HJV. **VE3PCA:** VE2ZP, VE3KKB. **PY1VOY/PY1RR:** PY1VOY & PY1RR. **LZ1KDP:** LZ2CJ, LZ1GC, N. Ikonomov. **OK1MMW** & OK1DFW. **OK1KSO:** OK1AEZ, OK1JJB, OK1JKT, OK1WT. **OK1KZD:** OK1DHJ, others. **OK3KAP:** OK3CGI, OK3CQA, OK3TPV. **OK1KPX:** OK1AHD, others. **OK1KQH:** Not shown. **OK1KRY:** OK1AQO, others. **OK2KYZ: OK2BPY, others. OK1KYS:** OK1FRF, others. **OK1KZW:** OK1DGE, OK1-21999. **OK1KMP:** Not shown. **OK1KTW:** OK1AAE, others. **G3RPB** & G3PQA, G3RAU. **UK2RDX:** UR2RRJ, UR2RNA, UR2-083-161, UR2-083-259. **DK0TU:** DF5GX, DL7WC. **DK0SU:** DL3SAS, DL5TT, DL5TV, DL9SAL. **DL0FJ:** DJ2EA, DC4LZ, DD4LY, DG3LL, DK4VP, DL4LV, DF5LA, DF7LF, DF8IM, DK8LN. **KH6DX** & KH6KV. **I0ONU:** I0JX, I0MGM. **JA9YBA:** JA9LJI, JA9LNJ, JH0CAZ. **JA3YBF:** JE3PED, JG3LZG, JH4CES, JH4IFF, JR4AGT, JA3-30356. **JA2YKA:** JG1GIF, JJ1BTA, JH2QXG, JR2GMC, JA9NFO, JA9SSY. **JA0YJA:** JA0EPV, JA0FVF, JA0VBJ, JH0IKO, JH0QOL, JH0QOP. **UK2PCR:** UP2BBT, UP2BCR, UP2BDF, UP2BFL, UP2-038-728. **UK2BCC:** UP2BDW, UP2BJK, UP2-038-346. **UK2PRC:** UP2BBM, UP2BIL. **UK2PAD:** UP2BFI, UP2-038-1620. **CR9BH:** OH2BH, JA1MIN. **LA4O:** LA6EV, LA9HW, LA0BS. **GM3IGW:** G3IGW, G3BBD, G4MH. **UK5IBM:** UB5IHL, UB5INO, UB5ITU. **YU4FRS:** YU4AW, YU4VQT, Edin, Amir, Necko. **YU7JDE:** Laci, Li.

### Phone Multi-Op Station Crews

**K3YTL:** N3AVZ, WA3YON, WB3CAI, WB3FAA, WB3FYT. **WB4TVQ** & KC4BG, NW4I, WA4MOJ, WB4CWB, WB4PEI, WB4TZR. **W4CN:** KC4WQ, KD4U, NO4R, N4XM, WD4ARQ, WD4OSN. **WD4PRQ** & N4FNB, WD4PRP. **WA5WKO** & AF5M, KB5DN, KB5RF, KG5J, KI5Q, WD5HUH. **KA7AUH** & WB7TRU. **WB8PAT** & K8TV. **W8IMZ** & N8BJQ, W8ILC. **W9AZ:** AK9F, K9IFO, K9NR, W9HPR, WD9CSA. **KB0SF** & N0BSA. **KB0TJ** & N0BUP. **VE3BGA/2** & VE3HJV. **VP2E:** K8ND, WB8DQP. **LZ1KDP:** LZ2CJ, N. Ikonomov. **OK1KSO:** OK1AEZ, OK1JCW, OK1JKT. **OK1KCU/P:** Not given. **UK2RDX:** UR2RRJ, UR2-083-159, UR2-083-161. **UK4HAL:** Maximov, Bondarenko, Evstegneev. **KH6KV** & KH6DX. **UK2PCR:** UP2BBT, UP2BJY. **YU7JDE:** Laci, Ivan, Li.

*Highest scoring C.W. W/VE multi-op N5JJ. (Left to right) N5JJ, WB5WHR, KN5H, N5CDO, KG5U. K5WA took the picture.*


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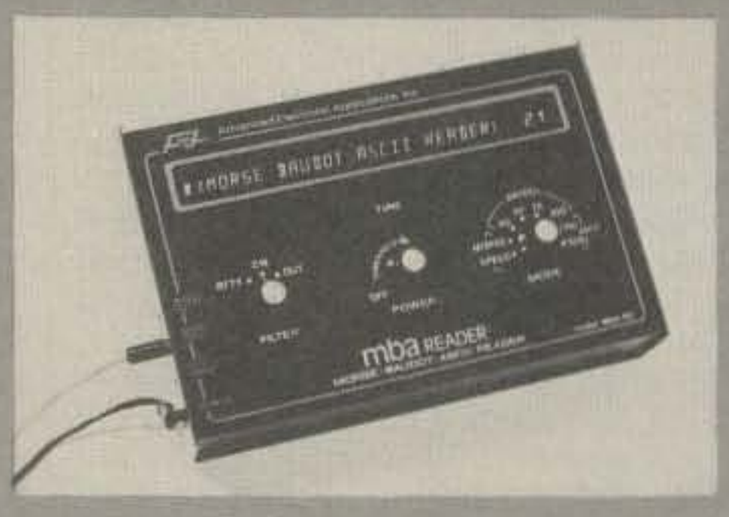


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# C.W. SCORES

**Number groups after calls denote score, total QSOs, 10-point QSOs, multiplier, and DXCC countries worked. Multi-op scores follow single-op listings.**

## SINGLE OPERATORS

### Connecticut

| | | | | | |
|---|---|---|---|---|---|
| W1XX | 44,004 | 334 | 13 | 57 | 13 |
| W1WY | 22,944 | 203 | 9 | 48 | 10 |

### Maine

| | | | | | |
|---|---|---|---|---|---|
| K1NBN | 15,792 | 156 | 8 | 42 | 10 |

### Massachusetts

| | | | | | |
|---|---|---|---|---|---|
| W1CF/1 | 92,550 | 421 | 49 | 75 | 29 |
| | | | (N1EE Op.) | | |
| W1PL | 23,814 | 183 | 15 | 49 | 13 |
| W1BB | 19,656 | 81 | 27 | 52 | 24 |

### New Hampshire

| | | | | | |
|---|---|---|---|---|---|
| W1FZ | 7,316 | 106 | 3 | 31 | 5 |

### New Jersey

| | | | | | |
|---|---|---|---|---|---|
| W2FJ | 63,140 | 335 | 29 | 70 | 25 |
| W2CVW | 7,168 | 92 | 5 | 32 | 7 |
| N2IN | 6,664 | 111 | 2 | 28 | 4 |
| K2FL | 4,592 | 66 | 4 | 28 | 6 |
| W2TO | 2,832 | 47 | 3 | 24 | 5 |

### New York

| | | | | | |
|---|---|---|---|---|---|
| W2DW | 4,536 | 73 | 2 | 28 | 4 |
| W2IB | 3,402 | 43 | 5 | 27 | 7 |
| W2GKZ | 3,276 | 51 | 3 | 26 | 5 |
| K2MN | 2,496 | 48 | 1 | 24 | 3 |

### Delaware

| | | | | | |
|---|---|---|---|---|---|
| AA1K | 59,136 | 368 | 20 | 66 | 20 |

### Maryland

| | | | | | |
|---|---|---|---|---|---|
| N3CO | 26,226 | 259 | 5 | 47 | 7 |
| W3GG | 25,392 | 248 | 7 | 46 | 8 |
| W3ICM | 9,072 | 106 | 5 | 36 | 7 |
| W3GMG | 540 | 18 | 0 | 15 | 2 |

### Pennsylvania

| | | | | | |
|---|---|---|---|---|---|
| N3AMK | 68,442 | 509 | 13 | 61 | 14 |
| W3AP | 25,000 | 210 | 10 | 50 | 12 |
| W3CV | 17,952 | 143 | 11 | 48 | 13 |
| W3AJS | 8,960 | 120 | 2 | 35 | 4 |
| W3HDH | 5,084 | 70 | 3 | 31 | 5 |

### Alabama

| | | | | | |
|---|---|---|---|---|---|
| W8IM | 8,680 | 104 | 5 | 35 | 6 |

### Florida

| | | | | | |
|---|---|---|---|---|---|
| N4WW | 110,880 | 429 | 66 | 80 | 34 |
| N4IN | 74,550 | 317 | 45 | 75 | 30 |
| WA4SVO | 19,500 | 151 | 11 | 50 | 12 |
| W4BV | 4,216 | 60 | 2 | 31 | 4 |
| W4MLA | 750 | 25 | 0 | 15 | 1 |

### Georgia

| | | | | | |
|---|---|---|---|---|---|
| WB4RUA | 4,828 | 55 | 4 | 34 | 5 |
| W4JWO | 3,700 | 70 | 1 | 25 | 2 |

### North Carolina

| | | | | | |
|---|---|---|---|---|---|
| W4TMR | 50,160 | 412 | 7 | 57 | 9 |
| KQ4G | 112 | 8 | 0 | 7 | 1 |

### Virginia

| | | | | | |
|---|---|---|---|---|---|
| WB4URW | 69,278 | 449 | 17 | 67 | 18 |
| K4PQL | 44,576 | 342 | 14 | 56 | 15 |
| N4DW | 19,872 | 179 | 7 | 48 | 9 |
| KC4FD | 17,056 | 200 | 2 | 41 | 4 |
| W4YE | 9,804 | 121 | 2 | 38 | 4 |
| W4KFC | 8,352 | 100 | 4 | 36 | 6 |
| W4KMS | 7,656 | 100 | 4 | 33 | 6 |
| K4OD | 6,336 | 79 | 5 | 32 | 6 |
| N4MM | 2,392 | 40 | 3 | 23 | 5 |

### Arkansas

| | | | | | |
|---|---|---|---|---|---|
| K5GO | 86,478 | 533 | 19 | 71 | 19 |
| W5KL | 12,084 | 159 | 0 | 38 | 2 |

### Louisiana

| | | | | | |
|---|---|---|---|---|---|
| W5KC | 2,250 | 33 | 3 | 25 | 5 |

### New Mexico

| | | | | | |
|---|---|---|---|---|---|
| W5YZ | 30,056 | 269 | 5 | 52 | 6 |

### Oklahoma

| | | | | | |
|---|---|---|---|---|---|
| K5JZN | 28,620 | 242 | 7 | 53 | 9 |

### Texas

| | | | | | |
|---|---|---|---|---|---|
| KB5UL | 7,560 | 100 | 2 | 35 | 4 |
| W5FIX | 7,208 | 90 | 4 | 34 | 6 |

### California

| | | | | | |
|---|---|---|---|---|---|
| K3VA/6 | 80,724 | 367 | 71 | 62 | 16 |
| K6DDO | 59,000 | 312 | 47 | 59 | 14 |
| K6XT | 46,746 | 277 | 41 | 53 | 11 |
| N6ND | 44,838 | 291 | 33 | 53 | 10 |
| K6MO | 15,260 | 126 | 23 | 35 | 6 |
| AD6D | 12,880 | 125 | 9 | 40 | 7 |
| K6SE | 9,856 | 80 | 24 | 28 | 6 |
| N6VR | 8,432 | 104 | 5 | 34 | 6 |
| W6BIP | 7,564 | 98 | 6 | 31 | 6 |
| K6TS | 3,520 | 68 | 3 | 22 | 4 |
| W6OUL | 980 | 41 | 2 | 10 | 2 |
| W6HDO | 648 | 27 | 0 | 12 | 1 |

### Arizona

| | | | | | |
|---|---|---|---|---|---|
| WB7FDQ | 24,600 | 226 | 5 | 50 | 6 |

### Idaho

| | | | | | |
|---|---|---|---|---|---|
| KA7BTQ | 19,680 | 193 | 3 | 48 | 5 |
| N7SU | 13,840 | 157 | 4 | 40 | 5 |

### Nevada

| | | | | | |
|---|---|---|---|---|---|
| W7XZ | 28,512 | 237 | 15 | 48 | 8 |

### Utah

| | | | | | |
|---|---|---|---|---|---|
| K7CPC | 1,536 | 48 | 0 | 16 | 2 |

### Washington

| | | | | | |
|---|---|---|---|---|---|
| W7TJ | 22,176 | 179 | 13 | 48 | 9 |
| W7BYK | 11,736 | 143 | 5 | 36 | 6 |
| WA7SHN | 5,148 | 79 | 5 | 26 | 6 |
| AK7F | 624 | 18 | 2 | 12 | 3 |

### Michigan

| | | | | | |
|---|---|---|---|---|---|
| KC8P | 42,480 | 316 | 11 | 59 | 12 |
| K8XX | 37,236 | 277 | 11 | 58 | 13 |
| W8VSK | 8,928 | 112 | 3 | 36 | 5 |
| K8LJG | 5,104 | 80 | 2 | 29 | 4 |
| K8CV | 4,428 | 78 | 1 | 27 | 3 |

### Ohio

| | | | | | |
|---|---|---|---|---|---|
| K8US | 51,198 | 451 | 8 | 53 | 9 |
| WB8JBM | 49,610 | 427 | 6 | 55 | 7 |
| | | | (WD8IJP Op.) | | |
| K8JK | 42,448 | 331 | 12 | 56 | 11 |
| W8IMZ | 28,224 | 268 | 5 | 49 | 7 |
| | | | (N8BJQ Op.) | | |
| N8TN | 17,280 | 200 | 4 | 40 | 6 |
| AA8S | 15,600 | 187 | 2 | 40 | 4 |
| K8SVT | 14,940 | 146 | 5 | 45 | 6 |
| KA8JRI | 13,840 | 157 | 4 | 40 | 6 |
| K8HF | 7,700 | 102 | 2 | 35 | 4 |
| K8MR | 4,620 | 69 | 2 | 30 | 4 |
| KB8LH | 2,596 | 55 | 1 | 22 | 3 |

### West Virginia

| | | | | | |
|---|---|---|---|---|---|
| K8OQL | 11,026 | 125 | 6 | 37 | 7 |

### Indiana

| | | | | | |
|---|---|---|---|---|---|
| W9LT | 62,496 | 456 | 10 | 63 | 12 |
| W9RE | 34,112 | 300 | 7 | 52 | 8 |
| K9IFO | 29,422 | 297 | 4 | 47 | 6 |
| WB9GCU | 14,196 | 178 | 1 | 39 | 3 |
| WD9BKN | 1,024 | 32 | 0 | 16 | 1 |

### Illinois

| | | | | | |
|---|---|---|---|---|---|
| KK9A | 36,260 | 350 | 5 | 49 | 7 |
| W9PNE | 34,770 | 269 | 9 | 57 | 11 |
| K9MDO | 9,360 | 112 | 2 | 39 | 4 |
| W9NEC | 8,280 | 111 | 1 | 36 | 3 |
| K9BG | 7,560 | 93 | 3 | 36 | 5 |
| K9YJL | 6,392 | 86 | 2 | 34 | 4 |

### Wisconsin

| | | | | | |
|---|---|---|---|---|---|
| WA9TZE | 16,684 | 182 | 3 | 43 | 5 |
| K9JXW | 8,968 | 106 | 3 | 38 | 5 |
| KE9A | 6,336 | 83 | 4 | 32 | 6 |
| WB9HRO | 3,456 | 60 | 1 | 27 | 3 |

### Iowa

| | | | | | |
|---|---|---|---|---|---|
| KØGVB | 31,692 | 242 | 9 | 57 | 11 |

### Kansas

| | | | | | |
|---|---|---|---|---|---|
| WAØTKJ | 11,316 | 126 | 3 | 41 | 5 |

### Minnesota

| | | | | | |
|---|---|---|---|---|---|
| WØHW | 28,100 | 265 | 4 | 50 | 6 |

### Missouri

| | | | | | |
|---|---|---|---|---|---|
| KØJPL | 11,692 | 150 | 2 | 37 | 4 |

### New Brunswick

| | | | | | |
|---|---|---|---|---|---|
| VE1AXT | 20,304 | 172 | 11 | 47 | 13 |

### Newfoundland

| | | | | | |
|---|---|---|---|---|---|
| VO1HP | 6,180 | 51 | 13 | 30 | 12 |

### Nova Scotia

| | | | | | |
|---|---|---|---|---|---|
| VE1IV | 7,280 | 114 | 4 | 28 | 6 |

### Quebec

| | | | | | |
|---|---|---|---|---|---|
| VE2WA | 8,052 | 110 | 3 | 33 | 5 |

### Ontario

| | | | | | |
|---|---|---|---|---|---|
| VE3ABG | 46,368 | 370 | 11 | 56 | 11 |
| VE3INQ | 25,700 | 225 | 8 | 50 | 10 |
| VE3BMV | 9,196 | 109 | 3 | 38 | 5 |

### Saskatchewan

| | | | | | |
|---|---|---|---|---|---|
| VE5XU | 9,030 | 125 | 1 | 35 | 3 |

### Alberta

| | | | | | |
|---|---|---|---|---|---|
| VE6OU | 5,936 | 106 | 0 | 28 | 2 |

### Aland Is.

| | | | | | |
|---|---|---|---|---|---|
| OHØNA | 22,680 | 189 | 0 | 24 | 24 |

### Antarctica

| | | | | | |
|---|---|---|---|---|---|
| VP8ANT | 21,000 | 76 | 44 | 35 | 16 |

### Argentina

| | | | | | |
|---|---|---|---|---|---|
| LU1DZ | 195 | 8 | 1 | 5 | 5 |

### Asiatic Russia

| | | | | | |
|---|---|---|---|---|---|
| UA9MR | 14,875 | 122 | 0 | 25 | 25 |
| EZ9MAB | 513 | 12 | 0 | 9 | 9 |

### Australia

| | | | | | |
|---|---|---|---|---|---|
| VK3BEE | 1,375 | 24 | 7 | 11 | 6 |

### Austria

| | | | | | |
|---|---|---|---|---|---|
| OE1TKW | 14,856 | 125 | 0 | 24 | 24 |

### Azerbaijan

| | | | | | |
|---|---|---|---|---|---|
| UD6BW | 9,020 | 82 | 0 | 22 | 22 |

### Bulgaria

| | | | | | |
|---|---|---|---|---|---|
| LZ2CW | 6,069 | 72 | 0 | 17 | 17 |

### Corsica

| | | | | | |
|---|---|---|---|---|---|
| FC9VN | 12,120 | 101 | 0 | 24 | 24 |

### Czechoslovakia

| | | | | | |
|---|---|---|---|---|---|
| OL6BAB/P | 57,105 | 286 | 8 | 47 | 43 |
| OL3AXS/P | 48,165 | 294 | 4 | 39 | 37 |
| OK3CXF | 39,710 | 260 | 0 | 38 | 38 |
| OK1DVK | 38,684 | 257 | 0 | 38 | 38 |
| OK1DFF | 35,742 | 240 | 0 | 37 | 37 |
| OK3CQR | 32,880 | 203 | 1 | 40 | 40 |
| OK3CQD | 30,204 | 211 | 0 | 36 | 36 |
| OK1KPU | 29,469 | 219 | 1 | 33 | 33 |
| | | | (OK1JDX Op.) | | |
| OK1DFP | 28,526 | 213 | 1 | 34 | 34 |
| OK1AXK | 22,707 | 201 | 0 | 29 | 29 |
| OL4BBP | 21,982 | 196 | 0 | 29 | 29 |
| OL1AYV | 19,920 | 178 | 1 | 30 | 30 |
| OK2HI | 18,060 | 151 | 0 | 30 | 30 |
| OK2EC | 17,951 | 164 | 0 | 29 | 29 |
| OK1OPT | 17,706 | 180 | 0 | 26 | 26 |
| OK1DCF | 16,965 | 153 | 0 | 29 | 29 |
| OK2QX | 15,596 | 145 | 0 | 28 | 28 |
| OL2BCC | 15,418 | 157 | 0 | 26 | 26 |
| OK2BWM | 15,390 | 153 | 0 | 27 | 27 |
| OL1BBR | 15,340 | 157 | 0 | 26 | 26 |
| OK1PGF/P | 13,902 | 67 | 4 | 42 | 42 |
| OK1MNW | 13,468 | 125 | 0 | 28 | 28 |
| OK1KUA | 13,128 | 149 | 0 | 24 | 24 |
| OK3BRK | 13,064 | 152 | 0 | 23 | 23 |
| OK1TJ | 11,352 | 127 | 0 | 24 | 24 |
| OK1AIJ | 10,978 | 140 | 0 | 22 | 22 |
| OL4BEV | 10,810 | 124 | 0 | 23 | 23 |
| OK1KRQ | 10,296 | 126 | 0 | 22 | 22 |
| | | | (OK1-19973 Op.) | | |
| OK2BCJ | 10,224 | 105 | 0 | 24 | 24 |
| OK3KFO | 10,051 | 121 | 0 | 23 | 23 |
| OL5AZY | 9,548 | 118 | 0 | 22 | 22 |
| OL7BAU | 9,534 | 119 | 0 | 21 | 21 |
| OK2BMU | 9,218 | 118 | 0 | 22 | 22 |
| OK1FBH | 9,108 | 66 | 0 | 33 | 33 |
| OK2BEJ | 9,093 | 119 | 0 | 21 | 21 |
| OK1DEK | 8,280 | 111 | 0 | 20 | 20 |
| OK2PDT | 7,676 | 106 | 0 | 19 | 19 |
| OK2PAW | 7,420 | 109 | 0 | 20 | 20 |
| OK1MIW | 7,400 | 104 | 0 | 20 | 20 |
| OK1KPA | 7,398 | 102 | 0 | 18 | 18 |
| | | | (OK1-20991 Op.) | | |
| OK2SWD | 7,084 | 98 | 0 | 23 | 23 |
| OL5BAR | 7,049 | 106 | 0 | 19 | 19 |
| OK1MZO | 5,814 | 81 | 0 | 19 | 19 |
| OL6BCD | 5,670 | 99 | 0 | 18 | 18 |
| OK2PAM | 5,508 | 93 | 0 | 18 | 18 |
| OK3CWQ | 5,475 | 54 | 0 | 25 | 25 |
| OK2ABU | 4,416 | 84 | 0 | 16 | 16 |
| OK1AIA | 4,284 | 51 | 0 | 21 | 21 |
| OL6BDK | 4,179 | 47 | 0 | 21 | 21 |
| OL3AYN | 4,012 | 64 | 0 | 17 | 17 |
| OK1KZ | 3,390 | 62 | 0 | 15 | 15 |
| OK3KMS/P | 3,360 | 51 | 0 | 16 | 16 |
| | | | (OK3-22153 Op.) | | |
| OK1MSB | 3,136 | 50 | 0 | 16 | 16 |
| OK1AEH | 2,926 | 35 | 0 | 19 | 19 |
| OL7BDA | 2,509 | 53 | 0 | 13 | 13 |
| OK2IL | 2,208 | 33 | 0 | 16 | 16 |
| OL5BEX | 1,845 | 30 | 0 | 15 | 15 |
| OK2PGU | 1,768 | 21 | 1 | 17 | 17 |
| OK2BCI | 1,484 | 20 | 3 | 14 | 13 |
| OK1DKH | 1,089 | 32 | 0 | 9 | 9 |
| OL8CNI | 902 | 20 | 0 | 11 | 11 |
| OK2BQU | 720 | 12 | 0 | 12 | 12 |
| OK1ONH/P | 170 | 11 | 0 | 5 | 5 |
| | | | (OK1-19973 Op.) | | |
| OK1DXW/P | 125 | 5 | 0 | 5 | 5 |

### Denmark

| | | | | | |
|---|---|---|---|---|---|
| OZ1LO | 103,455 | 365 | 13 | 55 | 46 |
| OZ1W | 27,960 | 187 | 0 | 30 | 30 |

### England

| | | | | | |
|---|---|---|---|---|---|
| G3VRW | 38,124 | 236 | 1 | 36 | 36 |
| G3XTT | 34,669 | 209 | 0 | 37 | 37 |
| G3XWZ | 25,312 | 229 | 1 | 28 | 28 |

### Estonia

| | | | | | |
|---|---|---|---|---|---|
| UR2AO | 12,550 | 101 | 0 | 25 | 25 |
| UR2HB | 364 | 11 | 0 | 7 | 7 |

### European USSR

| | | | | | |
|---|---|---|---|---|---|
| UA3LEO | 27,660 | 188 | 0 | 30 | 30 |

### Faroe Islands

| | | | | | |
|---|---|---|---|---|---|
| OY7ML | 1,260 | 18 | 0 | 14 | 14 |

### Finland

| | | | | | |
|---|---|---|---|---|---|
| OH6NG | 31,383 | 195 | 0 | 33 | 33 |
| OH1MA | 27,435 | 180 | 0 | 31 | 31 |
| OH2BO | 20,400 | 119 | 4 | 34 | 32 |
| OH2BNP | 17,966 | 143 | 0 | 26 | 26 |
| OH3TQ | 15,708 | 117 | 0 | 28 | 28 |
| OH2SX | 12,052 | 109 | 0 | 23 | 23 |
| OH2BVI | 3,652 | 35 | 0 | 22 | 22 |
| OH1UR | 259 | 8 | 0 | 7 | 7 |

### France

| | | | | | |
|---|---|---|---|---|---|
| F9KP | 47,775 | 278 | 1 | 35 | 35 |
| F8VJ | 8,554 | 60 | 7 | 26 | 23 |
| F3AT | 8,300 | 80 | 6 | 20 | 17 |
| F3BC | 3,328 | 53 | 0 | 13 | 13 |

### Germany, Fed Rep.

| | | | | | |
|---|---|---|---|---|---|
| DK6AS | 58,896 | 246 | 15 | 48 | 42 |
| DK3FB | 19,546 | 143 | 2 | 29 | 28 |
| DJ3XK | 17,951 | 134 | 0 | 29 | 29 |
| DJ3XD | 17,316 | 147 | 0 | 26 | 26 |
| DF3LP | 16,100 | 139 | 0 | 25 | 25 |
| DL8CM | 11,300 | 100 | 0 | 25 | 25 |
| DL1JF | 11,132 | 109 | 0 | 22 | 22 |
| DK4TA | 8,613 | 65 | 0 | 27 | 27 |
| DK5XF | 8,040 | 70 | 0 | 24 | 24 |

### Hawaii

| | | | | | |
|---|---|---|---|---|---|
| KH6IJ | 520 | 12 | 10 | 5 | 2 |

### Ireland

| | | | | | |
|---|---|---|---|---|---|
| EI9J | 33,495 | 195 | 8 | 33 | 29 |

### Israel

| | | | | | |
|---|---|---|---|---|---|
| 4X4NJ | 28,350 | 150 | 12 | 35 | 29 |

### Italy

| | | | | | |
|---|---|---|---|---|---|
| IR8ONU | 78,346 | 342 | 23 | 43 | 37 |
| | | | (I8ULL Op.) | | |

### Japan

| | | | | | |
|---|---|---|---|---|---|
| JA7NI | 7,992 | 145 | 11 | 18 | 15 |
| JA5DQH | 6,690 | 153 | 13 | 15 | 13 |
| JH1YDT | 3,804 | 96 | 13 | 12 | 9 |
| JA1DDH | 3,050 | 106 | 9 | 10 | 9 |
| JA1GTF | 1,800 | 70 | 8 | 8 | 7 |
| JA1BWA | 1,496 | 70 | 4 | 8 | 7 |
| JH1LHK | 1,358 | 63 | 7 | 7 | 6 |
| JE1SPY | 1,350 | 80 | 7 | 6 | 6 |
| JK1AJX | 552 | 58 | 2 | 4 | 4 |
| JE1CKA | 410 | 10 | 7 | 5 | 4 |
| JA9CWJ | 214 | 52 | 0 | 2 | 2 |
| JI1PCN | 82 | 41 | 0 | 1 | 1 |
| JA3BCT | 70 | 16 | 0 | 2 | 2 |
| JH2XTV | 60 | 30 | 0 | 1 | 1 |
| JA1KXT | 60 | 30 | 0 | 1 | 1 |
| JK1LUY | 30 | 15 | 0 | 1 | 1 |

### Kazakh

| | | | | | |
|---|---|---|---|---|---|
| UL7PBY | 16,389 | 122 | 0 | 27 | 27 |

### Kaliningradsk

| | | | | | |
|---|---|---|---|---|---|
| UA2FES | 3,738 | 54 | 0 | 14 | 14 |

### Latvia

| | | | | | |
|---|---|---|---|---|---|
| UQ2PM | 7,980 | 76 | 0 | 21 | 21 |

### Lithuania

| | | | | | |
|---|---|---|---|---|---|
| UP2BAW | 56,121 | 291 | 1 | 39 | 39 |
| UP2BIO | 38,773 | 274 | 0 | 29 | 29 |
| UP2PCB | 616 | 23 | 0 | 7 | 7 |
| UP2OU | 116 | 10 | 0 | 4 | 4 |
| UP2ND | 8 | 4 | 0 | 1 | 1 |
| UK2PAM | 8 | 4 | 0 | 1 | 1 |

### Maritime Mobile Region 2

| | | | | | |
|---|---|---|---|---|---|
| K3SXA/MM | 128,790 | 249 | 237 | 53 | 12 |

### Moldavia

| | | | | | |
|---|---|---|---|---|---|
| UO5ODB | 13,375 | 107 | 0 | 25 | 25 |

### Netherlands

| | | | | | |
|---|---|---|---|---|---|
| PAØHIP | 104,937 | 350 | 23 | 57 | 45 |
| PAØLOU | 33,948 | 189 | 2 | 36 | 36 |
| PAØMS | 17,040 | 174 | 0 | 20 | 20 |
| PA3BFM | 14,525 | 118 | 0 | 25 | 25 |
| PAØMRN | 3,520 | 64 | 0 | 11 | 11 |

### Netherlands Antilles

| | | | | | |
|---|---|---|---|---|---|
| W1BIH/PJ2 | 30,710 | 89 | 77 | 37 | 11 |

### Panama

| | | | | | |
|---|---|---|---|---|---|
| HP1XAT | 33,372 | 96 | 90 | 36 | 8 |

### Philippines

| | | | | | |
|---|---|---|---|---|---|
| KP4KK/DU2 | 6,780 | 110 | 3 | 12 | 11 |

### Puerto Rico

| | | | | | |
|---|---|---|---|---|---|
| NP4A | 525,705 | 599 | 445 | 101 | 51 |
| | | | (K1ZM Op.) | | |

### Sierra Leone

| | | | | | |
|---|---|---|---|---|---|
| 9L1SL | 495 | 10 | 1 | 9 | 9 |

### Singapore

| | | | | | |
|---|---|---|---|---|---|
| 9V1TK | 20 | 2 | 0 | 2 | 2 |

### Spain

| | | | | | |
|---|---|---|---|---|---|
| EA2OP | 116,171 | 363 | 32 | 59 | 42 |

### Surinam

| | | | | | |
|---|---|---|---|---|---|
| W6KG/PZ1 | 6,720 | 36 | 28 | 21 | 8 |

### Tadzhik

| | | | | | |
|---|---|---|---|---|---|
| UT5AB/UJ8 | 6,600 | 66 | 0 | 20 | 20 |

### Turkoman

| | | | | | |
|---|---|---|---|---|---|
| UH8DC | 4,370 | 46 | 0 | 19 | 19 |

### Turks & Caicos Is.

| | | | | | |
|---|---|---|---|---|---|
| VP5SMX | 7,410 | 39 | 39 | 19 | 2 |

### Ukraine

| | | | | | |
|---|---|---|---|---|---|
| UB5ZAL | 40,092 | 217 | 0 | 39 | 39 |
| UB5UWO | 26,722 | 182 | 0 | 31 | 31 |
| EZ5WAB | 24,750 | 171 | 0 | 30 | 30 |
| UB5UKO | 15,036 | 111 | 0 | 28 | 28 |
| UB5VK | 6,846 | 67 | 0 | 21 | 21 |
| UB5ZAT | 5,319 | 40 | 0 | 27 | 27 |
| EZ5NAA | 4,275 | 63 | 0 | 15 | 15 |
| UB5ES | 4,125 | 58 | 0 | 15 | 15 |

### Virgin Islands

| | | | | | |
|---|---|---|---|---|---|
| KV4FZ | 390,235 | 496 | 424 | 85 | 36 |

### Wales

| | | | | | |
|---|---|---|---|---|---|
| GW3NYY | 79,759 | 328 | 15 | 47 | 41 |
| GW3GWX | 10,758 | 99 | 0 | 22 | 22 |

### White Russia

| | | | | | |
|---|---|---|---|---|---|
| RC2WBR | 2,040 | 46 | 0 | 8 | 8 |

### Yugoslavia

| | | | | | |
|---|---|---|---|---|---|
| YU3EF | 82,957 | 325 | 22 | 49 | 39 |
| YU7BCD | 65,458 | 282 | 11 | 46 | 40 |
| YU2UE | 29,271 | 184 | 0 | 33 | 33 |

## MULTI-OPERATORS

### Massachusetts

| | | | | | |
|---|---|---|---|---|---|
| W1MX | 72,800 | 440 | 30 | 65 | 22 |

### Rhode Island

| | | | | | |
|---|---|---|---|---|---|
| N1DM | 17,556 | 207 | 6 | 38 | 7 |

### New York

| | | | | | |
|---|---|---|---|---|---|
| K2GBH | 26,304 | 254 | 5 | 48 | 7 |

### Pennsylvania

| | | | | | |
|---|---|---|---|---|---|
| W3TS | 68,408 | 427 | 19 | 68 | 19 |
| K3YTL | 17,220 | 202 | 2 | 41 | 4 |

### Alabama

| | | | | | |
|---|---|---|---|---|---|
| N4KG | 32,968 | 281 | 9 | 52 | 11 |

### Florida

| | | | | | |
|---|---|---|---|---|---|
| N4BP | 54,168 | 340 | 26 | 61 | 18 |

### Kentucky

| | | | | | |
|---|---|---|---|---|---|
| W4CN | 40,000 | 376 | 6 | 50 | 7 |
| NM4A | 33,500 | 331 | 1 | 50 | 3 |

### North Carolina

| | | | | | |
|---|---|---|---|---|---|
| W3ESU/4 | 40,828 | 302 | 11 | 59 | 13 |

### South Carolina

| | | | | | |
|---|---|---|---|---|---|
| K4CNW | 55,800 | 386 | 16 | 62 | 15 |

### Tennessee

| | | | | | |
|---|---|---|---|---|---|
| N4ARO | 27,768 | 231 | 9 | 52 | 9 |

### Virginia

| | | | | | |
|---|---|---|---|---|---|
| N4DJ | 49,796 | 370 | 13 | 59 | 13 |

### Oklahoma

| | | | | | |
|---|---|---|---|---|---|
| W7FG | 44,800 | 348 | 13 | 56 | 13 |

### Texas

| | | | | | |
|---|---|---|---|---|---|
| N5JJ | 92,500 | 509 | 29 | 74 | 25 |
| N5DU | 51,200 | 328 | 18 | 64 | 18 |
| K5EJA | 19,992 | 168 | 7 | 51 | 8 |

### California

| | | | | | |
|---|---|---|---|---|---|
| WB6EGE | 4,482 | 75 | 2 | 27 | 4 |

### Washington

| | | | | | |
|---|---|---|---|---|---|
| K7XX | 65,472 | 348 | 45 | 62 | 18 |
| KG7D | 21,068 | 189 | 10 | 46 | 8 |

### Michigan

| | | | | | |
|---|---|---|---|---|---|
| N8EA | 62,000 | 444 | 14 | 62 | 15 |

### Ohio

| | | | | | |
|---|---|---|---|---|---|
| KS8S | 60,512 | 440 | 14 | 61 | 14 |
| W8SDL | 25,484 | 257 | 5 | 46 | 7 |

### Wisconsin

| | | | | | |
|---|---|---|---|---|---|
| WØAIH/9 | 64,852 | 483 | 10 | 62 | 12 |

### Colorado

| | | | | | |
|---|---|---|---|---|---|
| W7XR | 58,344 | 373 | 14 | 68 | 15 |
| KØKE | 29,106 | 281 | 4 | 49 | 6 |

### Quebec

| | | | | | |
|---|---|---|---|---|---|
| VE3BGA/2 | 12,540 | 153 | 3 | 38 | 5 |

### Ontario

| | | | | | |
|---|---|---|---|---|---|
| VE3PCA | 29,792 | 268 | 9 | 49 | 10 |

### Brazil

| | | | | | |
|---|---|---|---|---|---|
| PY1VOY/ PY1RR | 378 | 10 | 2 | 7 | 6 |

### Bulgaria

| | | | | | |
|---|---|---|---|---|---|
| LZ1KDP | 56,803 | 262 | 4 | 43 | 43 |

### Czechoslovakia

| | | | | | |
|---|---|---|---|---|---|
| OK1MMW | 58,168 | 316 | 6 | 44 | 42 |
| OK1KSO | 51,128 | 273 | 5 | 44 | 42 |
| OK1KZD | 35,261 | 241 | 0 | 37 | 37 |
| OK3KAP | 26,268 | 205 | 1 | 33 | 33 |
| OK1KPX | 13,501 | 157 | 0 | 23 | 23 |
| OK1KQH | 9,744 | 130 | 0 | 21 | 21 |
| OK1KRY | 8,208 | 120 | 0 | 18 | 18 |
| OK2KYZ | 7,218 | 103 | 0 | 18 | 18 |
| OK1KYS | 5,593 | 85 | 0 | 17 | 17 |
| OK1KZW | 5,292 | 90 | 0 | 18 | 18 |
| OK1KMP | 1,680 | 27 | 0 | 16 | 16 |
| OK1KTW | 215 | 14 | 0 | 5 | 5 |

### England

| | | | | | |
|---|---|---|---|---|---|
| G3RPB | 107,590 | 290 | 42 | 70 | 51 |

### Estonia

| | | | | | |
|---|---|---|---|---|---|
| UK2RDX | 99,700 | 395 | 5 | 50 | 48 |

### Germany, Fed. Rep.

| | | | | | |
|---|---|---|---|---|---|
| DKØTU | 50,122 | 283 | 6 | 38 | 36 |
| DKØSU | 36,352 | 253 | 0 | 32 | 32 |
| DLØFJ | 30,816 | 209 | 1 | 32 | 32 |

### Hawaii

| | | | | | |
|---|---|---|---|---|---|
| KH6DX | 55,594 | 181 | 114 | 38 | 9 |

### Italy

| | | | | | |
|---|---|---|---|---|---|
| IØONU | 53,280 | 263 | 4 | 40 | 39 |

### Japan

| | | | | | |
|---|---|---|---|---|---|
| JA9YBA | 4,634 | 109 | 10 | 14 | 12 |
| JA3YBF | 3,179 | 111 | 5 | 11 | 11 |
| JA2YKA | 1,939 | 107 | 6 | 7 | 7 |
| JAØYJA | 86 | 43 | 0 | 1 | 1 |

### Lithuania

| | | | | | |
|---|---|---|---|---|---|
| UK2PCR | 106,400 | 430 | 7 | 50 | 46 |
| UK2BCC | 50,365 | 294 | 1 | 35 | 35 |
| UK2PRC | 20,825 | 169 | 0 | 25 | 25 |
| UK2PAD | 3,003 | 51 | 0 | 13 | 13 |

### Macau

| | | | | | |
|---|---|---|---|---|---|
| CR9BH | 320 | 32 | 0 | 2 | 2 |

### Norway

| | | | | | |
|---|---|---|---|---|---|
| LA4O | 50,886 | 309 | 0 | 33 | 33 |

### Scotland

| | | | | | |
|---|---|---|---|---|---|
| GM3IGW | 95,877 | 339 | 27 | 53 | 42 |

### Ukraine

| | | | | | |
|---|---|---|---|---|---|
| UK5IBM | 21,450 | 149 | 0 | 30 | 30 |

### Yugoslavia

| | | | | | |
|---|---|---|---|---|---|
| YU4FRS | 50,680 | 252 | 8 | 40 | 36 |
| YU7JDE | 44,800 | 262 | 0 | 35 | 35 |

**Check logs are gratefully acknowledged from the following:** W9CG, WØAP, EZ5ITQ, OH1XX, OK1DIJ, OK1IAR, OK1OFK, OK2BPL, UA2FCB.

# PHONE SCORES

## SINGLE OPERATORS

### Connecticut

| | | | | | |
|---|---|---|---|---|---|
| WB1CWZ | 15,334 | 167 | 5 | 41 | 7 |
| W1WY | 8,832 | 118 | 5 | 32 | 6 |

### Maine

| | | | | | |
|---|---|---|---|---|---|
| K1NBN | 14,952 | 158 | 5 | 42 | 7 |

### Massachusetts

| | | | | | |
|---|---|---|---|---|---|
| W1CF | 127,020 | 710 | 40 | 73 | 22 |
| | | | (WB3GCG Op.) | | |
| W1BB | 2,508 | 37 | 5 | 22 | 6 |

### New Hampshire

| | | | | | |
|---|---|---|---|---|---|
| K1MNS | 44,800 | 364 | 9 | 56 | 10 |

### Rhode Island

| | | | | | |
|---|---|---|---|---|---|
| AD1P | 13,908 | 159 | 6 | 38 | 7 |
| W1LOV | 3,408 | 67 | 1 | 24 | 3 |

### Vermont

| | | | | | |
|---|---|---|---|---|---|
| K1LPS | 18,480 | 186 | 6 | 44 | 7 |

### New Jersey

| | | | | | |
|---|---|---|---|---|---|
| W2FJ | 33,512 | 228 | 14 | 59 | 13 |
| K2FL | 12,320 | 134 | 5 | 40 | 7 |

### New York

| | | | | | |
|---|---|---|---|---|---|
| WA2SPL | 93,600 | 624 | 24 | 65 | 18 |
| K2BQ | 51,852 | 391 | 14 | 58 | 13 |

### Maryland

| | | | | | |
|---|---|---|---|---|---|
| W3YOZ | 44,352 | 360 | 9 | 56 | 9 |
| N3CO | 20,496 | 220 | 6 | 42 | 7 |
| W3GG | 19,360 | 192 | 7 | 44 | 8 |
| K3IXD | 16,318 | 183 | 4 | 41 | 5 |
| W3ICM | 12,690 | 113 | 7 | 45 | 9 |
| K3VY | 1,254 | 29 | 1 | 19 | 2 |

| | | | | | |
|---|---|---|---|---|---|
| **Pennsylvania** | | | | | |
| N3AMK | 75,480 | 573 | 14 | 60 | 12 |
| W3TS | 36,080 | 284 | 11 | 55 | 11 |
| K3FN | 15,180 | 137 | 7 | 46 | 8 |
| W3AP | 5,394 | 85 | 2 | 29 | 4 |
| W3ETB | 1,216 | 38 | 0 | 16 | 2 |
| **Alabama** | | | | | |
| W8IM | 216 | 12 | 0 | 9 | 1 |
| **Florida** | | | | | |
| N4WW | 70,980 | 458 | 22 | 65 | 17 |
| AA4MM | 42,572 | 299 | 17 | 58 | 14 |
| N4IN | 41,664 | 260 | 19 | 62 | 17 |
| WA4SVO | 21,756 | 186 | 9 | 49 | 10 |
| W4PZV | 19,968 | 168 | 10 | 48 | 9 |
| W4HVU | 3,744 | 52 | 5 | 26 | 6 |
| **Kentucky** | | | | | |
| NQ4C | 14,852 | 150 | 2 | 47 | 4 |
| **North Carolina** | | | | | |
| N4AYO | 48,042 | 435 | 9 | 51 | 10 |
| K8CFU | 18,810 | 119 | 13 | 55 | 14 |
| KB4YT | 700 | 21 | 1 | 14 | 2 |
| **South Carolina** | | | | | |
| K4CNW | 49,400 | 431 | 11 | 52 | 11 |
| **Tennessee** | | | | | |
| KC40V | 47,712 | 398 | 7 | 56 | 9 |
| N4ARO | 33,770 | 275 | 8 | 55 | 10 |
| **Virginia** | | | | | |
| N4MM | 30,634 | 265 | 6 | 53 | 8 |
| W4KMS | 7,700 | 90 | 5 | 35 | 6 |
| W1LUG/4 | 1,680 | 42 | 0 | 20 | 2 |
| **Arkansas** | | | | | |
| K5UR | 31,552 | 240 | 8 | 58 | 9 |
| WA5NFC | 16,128 | 176 | 4 | 42 | 6 |
| **Mississippi** | | | | | |
| W5GWD | 2,184 | 42 | 0 | 26 | 2 |
| **Oklahoma** | | | | | |
| W7FG | 79,632 | 596 | 9 | 63 | 11 |
| **Texas** | | | | | |
| N5JB | 42,224 | 353 | 6 | 56 | 8 |
| **California** | | | | | |
| K6HNZ | 36,504 | 323 | 7 | 52 | 7 |
| K6MO | 2,500 | 46 | 1 | 25 | 3 |
| WA6AUE | 1,428 | 47 | 1 | 14 | 3 |
| **Arizona** | | | | | |
| WB7FDQ | 35,298 | 317 | 4 | 53 | 6 |
| **Idaho** | | | | | |
| KA7BTQ | 8,712 | 113 | 2 | 36 | 4 |
| N7SU | 7,140 | 111 | 2 | 30 | 4 |
| **Montana** | | | | | |
| K7VIC | 15,664 | 170 | 2 | 44 | 4 |
| **Nevada** | | | | | |
| KA7BRE | 12,960 | 168 | 3 | 36 | 4 |
| **Utah** | | | | | |
| N7DF | 61,876 | 459 | 10 | 62 | 10 |
| **Washington** | | | | | |
| AK7F | 80 | 8 | 0 | 5 | 2 |
| **Michigan** | | | | | |
| KC8P | 55,974 | 459 | 8 | 57 | 9 |
| KB8HW | 31,008 | 295 | 7 | 48 | 9 |
| N8BIC | 20,586 | 203 | 4 | 47 | 6 |
| KC8A | 16,560 | 218 | 3 | 36 | 4 |
| **Ohio** | | | | | |
| K8US | 70,224 | 585 | 8 | 57 | 9 |
| WB8JBM | 69,600 | 560 | 10 | 58 | 9 |
| | | | (N8ATR Op.) | | |
| K8MN | 60,756 | 446 | 13 | 61 | 12 |
| KB8LH | 17,100 | 209 | 4 | 38 | 5 |
| WA8GMT | 13,040 | 147 | 4 | 40 | 5 |
| N8TN | 11,628 | 159 | 3 | 34 | 5 |
| K8SVT | 11,398 | 123 | 4 | 41 | 6 |
| K8HF | 8,720 | 93 | 4 | 40 | 6 |
| WD8MRF | 7,840 | 100 | 3 | 35 | 5 |
| KC8JH | 5,520 | 80 | 3 | 30 | 5 |
| KC8NR | 5,280 | 80 | 2 | 30 | 4 |
| **West Virginia** | | | | | |
| W8LRL | 129,000 | 736 | 31 | 75 | 22 |
| W8VEN | 5,518 | 85 | 1 | 31 | 3 |
| **Illinois** | | | | | |
| K9YJL | 5,544 | 99 | 0 | 28 | 2 |
| W9PNE | 960 | 22 | 2 | 16 | 4 |
| **Indiana** | | | | | |
| W9RE | 33,182 | 333 | 5 | 47 | 7 |
| **Wisconsin** | | | | | |
| W9UP | 61,256 | 454 | 10 | 62 | 11 |
| WB9LSR | 29,184 | 296 | 2 | 48 | 4 |
| WA9TZE | 16,896 | 176 | 4 | 44 | 5 |
| **Colorado** | | | | | |
| KØUK | 47,200 | 372 | 7 | 59 | 9 |
| **Iowa** | | | | | |
| KAØHIG | 31,058 | 273 | 5 | 53 | 7 |
| KØGVB | 26,182 | 223 | 6 | 53 | 8 |
| WBØUFL | 7,590 | 111 | 1 | 33 | 3 |
| **Kansas** | | | | | |
| WAØTKJ | 38,720 | 320 | 8 | 55 | 9 |
| WØCM | 38,396 | 303 | 7 | 58 | 9 |
| **Minnesota** | | | | | |
| WØHW | 4,860 | 82 | 2 | 27 | 4 |
| **Missouri** | | | | | |
| WØPGI | 12,972 | 122 | 4 | 47 | 6 |
| **New Brunswick** | | | | | |
| VE1BQJ | 1,188 | 25 | 2 | 18 | 3 |
| **Nova Scotia** | | | | | |
| VE1YX | 28,254 | 229 | 12 | 51 | 12 |
| **Quebec** | | | | | |
| VE2QO | 1,330 | 35 | 0 | 19 | 2 |
| VE2QA | 360 | 15 | 0 | 12 | 2 |
| **Ontario** | | | | | |
| VE3INQ | 17,910 | 175 | 6 | 45 | 8 |
| VE3ABG | 8,642 | 145 | 1 | 29 | 3 |
| VE3KYT | 1,360 | 36 | 1 | 17 | 3 |
| **Saskatchewan** | | | | | |
| VE5XU | 560 | 20 | 0 | 14 | 2 |
| **Alberta** | | | | | |
| VE6AQI | 416 | 16 | 0 | 13 | 2 |
| **British Columbia** | | | | | |
| VE7WJ | 7,936 | 112 | 3 | 32 | 4 |
| **Argentina** | | | | | |
| LU9EIE | 175 | 5 | 2 | 5 | 4 |
| **Asiatic Russia** | | | | | |
| UA9MR | 918 | 21 | 0 | 9 | 9 |
| **Australia** | | | | | |
| VK3BEE | 264 | 22 | 2 | 4 | 3 |
| **Cayman Is.** | | | | | |
| ZF1EJ | 6,670 | 31 | 27 | 23 | 5 |
| **Czechoslovakia** | | | | | |
| OK1AJN | 2,640 | 36 | 0 | 16 | 16 |
| OK3KAP | 1,695 | 25 | 0 | 15 | 15 |
| | | | (OK3CGI Op.) | | |
| OK2EC | 1,534 | 26 | 0 | 13 | 13 |
| OK2SPS | 287 | 10 | 0 | 7 | 7 |
| **Dominican Rep.** | | | | | |
| HI8VMA | 6,118 | 33 | 22 | 23 | 9 |
| HI8DAF | 5,840 | 32 | 27 | 20 | 6 |
| **England** | | | | | |
| G3XTT | 11,200 | 106 | 1 | 28 | 28 |
| G3LNG | 10,469 | 85 | 4 | 29 | 26 |
| **European Russia** | | | | | |
| RA3DKE | 3,762 | 45 | 0 | 19 | 19 |
| UA6LHK | 2,800 | 41 | 0 | 16 | 16 |
| UA6WS | 210 | 12 | 0 | 5 | 5 |
| **Finland** | | | | | |
| OH2BNP | 6,636 | 65 | 0 | 21 | 21 |
| **Haiti** | | | | | |
| HH2B | 98,736 | 214 | 198 | 48 | 13 |
| **Italy** | | | | | |
| IR8ONU | 36,900 | 176 | 29 | 36 | 29 |
| | | | (I8UDB Op.) | | |
| **Latvia** | | | | | |
| RQ2GGI | 4,240 | 53 | 0 | 16 | 16 |
| **Lithuania** | | | | | |
| UP2BCG | 3,744 | 48 | 0 | 16 | 16 |
| **Maritime Mobile, Region 2** | | | | | |
| K3SXA/MM | 48,360 | 127 | 121 | 39 | 7 |
| **Mexico** | | | | | |
| XE1HHA | 6,745 | 36 | 35 | 19 | 2 |
| **Moldavia** | | | | | |
| UO5GQ | 1,150 | 23 | 0 | 10 | 10 |
| **Ukraine** | | | | | |
| UB5FDF | 6,489 | 69 | 0 | 21 | 21 |
| UB5PBA | 6,440 | 71 | 0 | 20 | 20 |
| UB5ABZ | 2,030 | 35 | 0 | 14 | 14 |
| UB5UKO | 1,834 | 31 | 0 | 14 | 14 |
| UB5IPN | 1,768 | 32 | 0 | 13 | 13 |
| UB5AAL | 1,534 | 29 | 0 | 13 | 13 |
| UB5UCH | 1,508 | 28 | 0 | 13 | 13 |
| RB5FCY | 1,308 | 26 | 0 | 12 | 12 |
| UB5AAQ | 869 | 20 | 0 | 11 | 11 |
| **Venezuela** | | | | | |
| YV3AZC | 30,832 | 80 | 71 | 41 | 9 |
| **Virgin Islands** | | | | | |
| KV4FZ | 278,330 | 448 | 412 | 65 | 21 |
| **Wales** | | | | | |
| GW4IOI | 20,790 | 164 | 2 | 27 | 26 |
| | | | (GW8TVX Op.) | | |
| **White Russia** | | | | | |
| UC2XW | 3,440 | 43 | 0 | 16 | 16 |

## MULTI-OPERATORS

| | | | | | |
|---|---|---|---|---|---|
| **Pennsylvania** | | | | | |
| K3YTL | 24,376 | 265 | 3 | 44 | 5 |
| **Florida** | | | | | |
| WB4TVQ | 27,300 | 229 | 11 | 50 | 11 |
| **Kentucky** | | | | | |
| W4CN | 46,004 | 402 | 8 | 53 | 8 |
| **Tennessee** | | | | | |
| WD4PRQ | 20,496 | 232 | 3 | 42 | 5 |
| **Arkansas** | | | | | |
| WA5WKO | 69,120 | 532 | 11 | 60 | 10 |
| **Washington** | | | | | |
| KA7AUH | 12,324 | 150 | 2 | 39 | 4 |
| **Ohio** | | | | | |
| WB8PAT | 54,696 | 492 | 6 | 53 | 7 |
| W8IMZ | 47,824 | 399 | 7 | 56 | 8 |
| **Illinois** | | | | | |
| W9AZ | 49,648 | 400 | 7 | 58 | 8 |
| KK9A | 36,570 | 329 | 4 | 53 | 6 |
| **Colorado** | | | | | |
| KBØSF | 12,284 | 166 | 0 | 37 | 2 |
| KBØTJ | 12,240 | 153 | 0 | 40 | 2 |
| **Quebec** | | | | | |
| VE3BGA/2 | 14,508 | 166 | 5 | 39 | 7 |
| **Anguilla** | | | | | |
| VP2E | 275,520 | 446 | 417 | 64 | 20 |
| **Bulgaria** | | | | | |
| LZ1KDP | 26,565 | 141 | 12 | 35 | 30 |
| **Czechoslovakia** | | | | | |
| OK1KSO | 47,040 | 221 | 19 | 40 | 32 |
| OK1KCU/P | 3,944 | 50 | 0 | 17 | 17 |
| **Estonia** | | | | | |
| UK2RDX | 53,850 | 432 | 0 | 25 | 25 |
| **European Russia** | | | | | |
| UK4HAL | 1,729 | 32 | 0 | 13 | 13 |
| **Hawaii** | | | | | |
| KH6KV | 24,831 | 83 | 79 | 31 | 4 |
| **Lithuania** | | | | | |
| UK2PCR | 50,880 | 513 | 0 | 20 | 20 |
| **Yugoslavia** | | | | | |
| YU7JDE | 14,092 | 112 | 0 | 26 | 26 |

**Check logs are gratefully acknowledged from the following:** WA8LXJ, BRS 45205, UB5QJB, YU7AJD.


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FT10ZD/3 ..... 749.00
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FT208R/FT708R .. 289.00 ea.
FRG7700 ..... 449.00
**DRAKE** TR5 ..... 699.00
TR7A ..... 1450.00
R7A ..... 1400.00
**Cubic** 103 ..... 1095.00
**Bird** ..... Stock
**Kenwood** R600 ..... 299.00
TR7730/TTM ..... 299.00
**Tote 'n Talk** Cordless
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**NEW Signal/One Milspec** Soon
**Permitron** Wireless Burglar Alarm
3 Remotes ..... 199.00
**W6TOG** Kits ..... Stock
**Demo** TS530S ..... 600.00
**Alpha** 78AF
(Hi Serial No.) ..... 2795.00
**Kantronics** Interface ..... 169.00
Minireader ..... 249.00
**Santec** HT1200
+ Batt/cord ..... 269.00
**Belden** 99258, RG8X ... 19¢/ft.
8214, RG8 foam ..... 36¢/ft.
8267, RG213 ..... 43¢/ft.
8448, Rotor ..... 27¢/ft.
9405, HD Rotor ..... 45¢/ft.
**AEA** MBARO ..... 269.00
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# Awards

*a monthly feature by*
**A. EDWARD HOPPER, W2GT**

## NEWS OF CERTIFICATE AND AWARD COLLECTING

Here is the Story of the Month as told by Ruel:

### Ruel Samuels, 6Y5RS
### All Counties #331, 6-6-81

"In 1930 while I was a shift engineer with the power company in Port Antonio on the north coast of Jamaica, I became interested in radio and took an RCA correspondence course.

"By 1932 I became Jeeves to the only two hams in that town. With a little encouragement I might well have gotten a ticket then, but that was not to be. It was not until I migrated to Kingston, the capital city, that I had that encouragement, and I got my ticket in 1937. At that time I was engaged in domestic, marine, and industrial radio servicing. Along came WW II, and I did a three-year pitch at sea in the merchant navy as a radio operator.

"The war ended in 1945 and I resumed my business, this time including sales. In 1947 I was the first to install a privately owned radiotelephone system on the island; this was for a sugar manufacturing company. In 1949 I built and installed a pair of 500 MHz radiotelephone sets from war surplus material for the same company—again the first on the island. In those days such items could not be imported.

"I should mention that in 1937 my first transmitter was a Hartly oscillator with a 245 triode with a coil made of quarter-inch copper tubing, grid leak, condenser, etc., mounted on a piece of board 10″ × 12″. The band was 40 and power was 10 watts, which was the maximum allowed in Jamaica at that time.

"In 1951 I met Rundy, K4ZA (then W3ZA), and he made me Motorola's first overseas distributor. With his expert help I sold the first-ever v.h.f. f.m. communication system to be used in Jamaica. The system was engineered by Rundy for the Post & Telegraph Department. This system is still in operation as originally planned, only with the replacement of obsolete units.

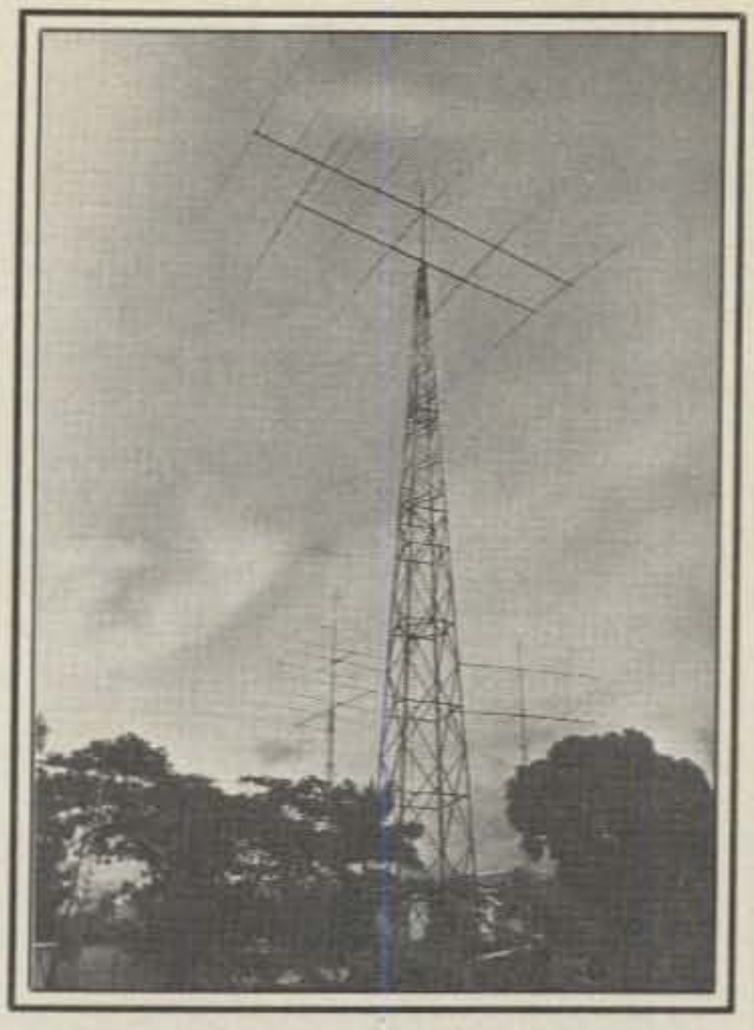
"I was the first to install a railroad two-way radio system on the island. In addition to the communication equipment business, in 1937 I erected an assembly plant in Kingston and currently assemble Zenith television and stereo equipment. Associated with me in the business is my wife Norma, 6Y5YL. We have the first and only factory assemblying color TV's on the island.

"I am the second oldest ham on the island, my senior being 6Y5AA (who just recently became a silent key). During my years of hamming I have been engaged in many national emergencies. I am a Scottish Rite Free Mason, and my many memberships include ARRL (life), *CQ* (life), QCWA (life), OOTC, IARC (life Ambassador), IEEE (58), and Radio Club of America. I also have WAS, WAC, and DXCC.

"In addition to the RCA course I mentioned, I also did courses with International correspondence schools and with the Motorola Training Institute and many in-plant Motorola training classes in Chicago." *(Of course, Ruel has the only USA-CA certificate in Jamaica—ed.)*

*P.O. Box 73, Rochelle Park, NJ 07662*

*Ruel and Norma Samuels, 6Y5RS and 6Y5YL, in their well-equipped station, including Collins S Line, Collins KWM 380/Alpha 77, Atlas 210X, Swan Astro 150, KLM 661 6 m xcvr, Azden 2000 2m xcvr, Motorola 2m portable, Tempo 2m portable. An Atlas 350XL/KLM KT 34 beam is at the plant. Plus they have a mobile unit Kenwood 120S/Hustler antenna.*



*The impressive antenna farm of 6Y5RS/6Y5YL.*

### Special Honor Roll
### All Counties

#393 David S. Short, W5PWG 8-7-82.
#394 Donald R. Strom, WA0LKL 8-16-82.
#395 Duane M. Musgrave, WB5CWI 8-21-82.
#396 Wayne R. Bergman, WA9IWM 8-21-82.
#397 James D. Crisp, Jr., KD4PY 9-4-82.
#398 Ron L. Moorefield, W8ILC 9-8-82.

### Awards Issued

Dave Short, W5PWG (ex-W2GRH, W4SKI, DL5DA), got USA-CA-500 in July 1964, and has been on the Net when possible. He got his paperwork together to apply for All Counties endorsed Mixed.

Don Strom, WA0LKL, added USA-CA-2000, 2500, 3000, and All Counties endorsed Mixed to his collection.

Duane Musgrave, WB5CWI, finished them to get All Counties endorsed All S.S.B., All 20, and USA-CA-500 through USA-CA-3000 endorsed All S.S.B., All 20, All Mobiles.

Wayne Bergman, WA9IWM, waited until he had them All to claim USA-CA-500 through All Counties endorsed All S.S.B.

Jim Crisp, KD4PY (ex-WB5DXP, WB4GHN, WA4NMH), also waited until he had them All to apply for USA-CA-500 through All Counties endorsed Mixed.

Ron Moorefield, W8ILC, was happy to add to his collection USA-CA-3000 and All Counties endorsed Mixed.

Michael Eilers, K8OOK, acquired USA-CA-500 through USA-CA-2500 endorsed All S.S.B., All 20, All Mobiles, and USA-CA-3000 endorsed Mixed.

Gianluigi Portinaro, I1POR, picked up USA-CA-500 endorsed All S.S.B. and USA-CA-1000 endorsed All Phone.

USA-CA-500 Certificates endorsed All S.S.B. went to:

Arturo Gigante, Jr., HI8GB (#2 to HI).

Rod Roderique, WA0QII, also endorsed All 20, All Mobile to Mobiles.

Hubert Loubere, F6DZU (#9 to France).

### USA-CA Honor Roll

| 3000 | | | | 500 | |
|---|---|---|---|---|---|
| K8OOK | 423 | WA0LKL | 539 | I1POR | 1760 |
| WB5CWI | 424 | WA9IWM | 540 | HI8GB | 1761 |
| WA0LKL | 425 | KD4PY | 541 | K8OOK | 1762 |
| WA9IWM | 426 | | | WA0QII | 1763 |
| KD4PY | 427 | **1500** | | DL3RK | 1764 |
| W8ILC | 428 | K8OOK | 602 | WB5CWI | 1765 |
| | | WB5CWI | 603 | OH3SG | 1766 |
| **2500** | | WA9IWM | 604 | KT5F | 1767 |
| K8OOK | 483 | KD4PY | 605 | WA9IWM | 1768 |
| WB5CWI | 484 | | | F6DZU | 1769 |
| WA0LKL | 485 | | | KD4PY | 1770 |
| WA9IWM | 486 | **1000** | | SM6CED | 1771 |
| KD4PY | 487 | I1POR | 737 | | |
| | | K8OOK | 738 | | |
| **2000** | | WB5CWI | 739 | | |
| K8OOK | 537 | WA9IWM | 740 | | |
| WB5CWI | 538 | KD4PY | 741 | | |

USA-CA-500 Certificates endorsed All CW were claimed by:

Walter Geyrhalter, DL3RK.

Tage Stromhall, SM6CED.

USA-CA-500 Certificates endorsed Mixed were won by:

Seppo Helin, OH3SG (#5 to OH).

Jim Hardee, KT5F (ex-WN5KOW, KA5IGP, KC5KF).

## Awards

**Hong Kong Amateur Radio Transmitting Society (HARTS) Awards:** The following three awards are available from HARTS.

*Catch 22 Award:* Applicant must submit evidence of two-way contact with other amateur stations located on the 22nd parallel of latitude north (see list). A contact with a Hong Kong station is obligatory. Only contacts after January 1980 are valid. Endorsement for mode and band may be requested. The award is available in three classes:

Class 3—Contacts with at least 15 countries.

Class 2—Contacts with at least 20 countries.

Class 1—Contacts with all 25 countries.

Fee: U.S. $7.00 or equivalent currency. All awards will be returned by airmail, and upgrade stickers may be applied for with a fee of U.S. $1.00.

Countries list: VS6 Hong Kong, CR9 Macau, BY China, BV Taiwan, XV Vietnam, XW Laos, XZ Burma, S2 Bangladesh, VU2 India, A4X Oman, A6X U.A.E., HZ Saudi Arabia, ST Sudan, SU Egypt, 5A Libya, TT8 Chad, 5UT Niger, 7X Algeria, TZ Mali, 5T5 Mauritania, CN Morocco, C6 Bahamas, CO Cuba, XE Mexico, KH6 Hawaii.

*Nine Dragons Award:* One contact with a country in each of the following zones: 18, 19, and 24 to 30 inclusive. Contact for zone 24 must be a VS6. Stations within the 9 zones require 2 contacts in each zone, with 2 VS6 contacts. Contacts after 1 January 1979 only are valid. Fee: U.S. $3.00, Aust. $3.00, 1.50 pound, postal order or 25 IRCs.

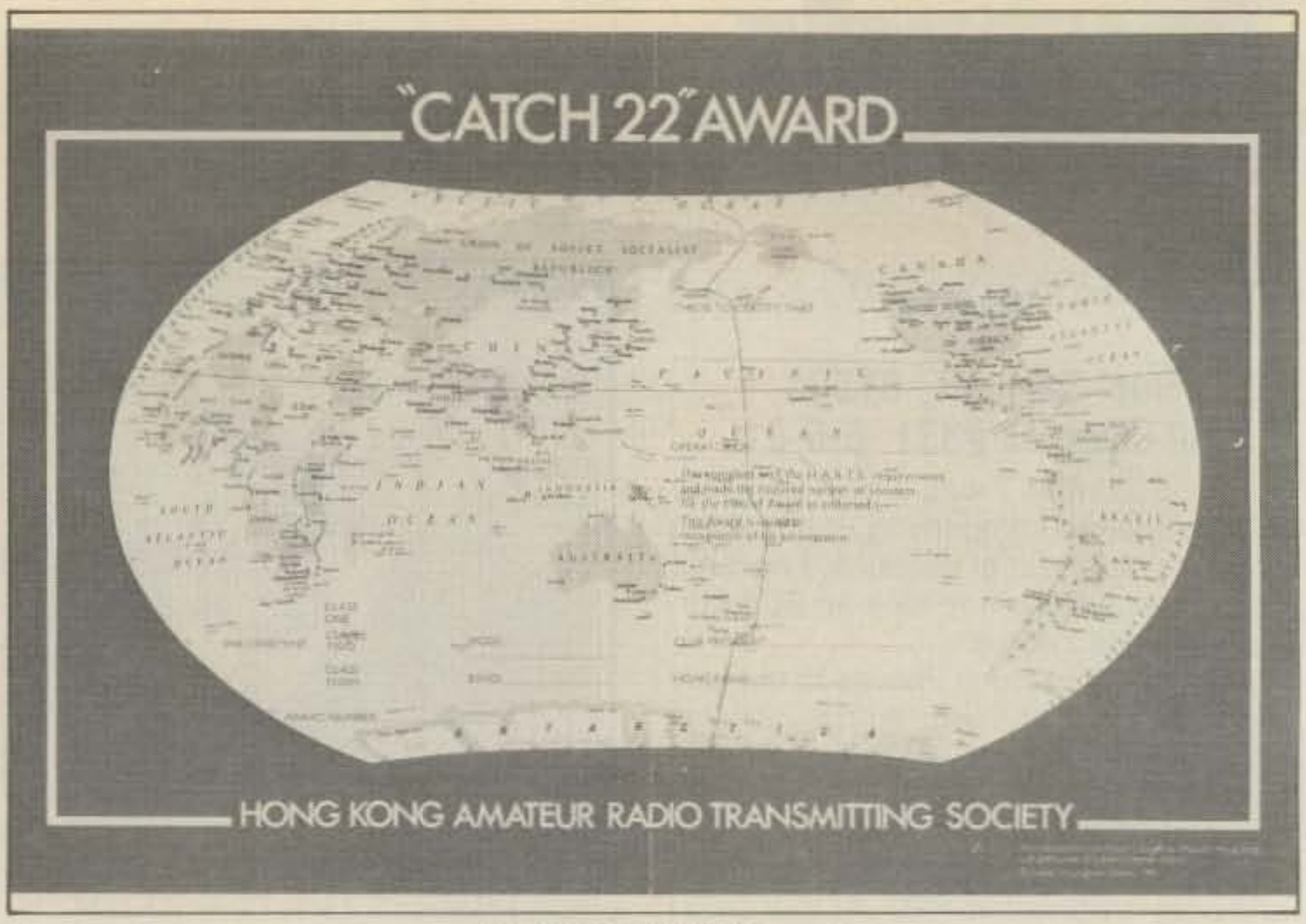
*Firecracker Award:* Six contacts with different VS6 stations. Stations in zones 18, 19, and 24 to 28 require 10 contacts with different VS6 stations. Contacts after 1 January 1964 only are valid. Fee: U.S. $2.00, Aust. $2.00, 1 pound, postal order or 10 IRCs.

*Usual Conditions for these three awards:* Certified log extracts only; *no* QSL's are required. Payment to be made in cash or check payable to HARTS. If sending postal orders, please leave payee blank. Send to: Awards Manager, HARTS, G.P.O. Box 541, Hong Kong.

**Australian Capital Chapter Award:** Sponsored by this 10-10 Chapter International. Chapter Requirements:

Basic, 15 points incl. 1C or 1HC, 2 points.

State, 100 points incl. 2C or 2HC, 3 points.




*HARTS Catch 22 Award.*

*Australian Capital Chapter Award.*

Constitution, 200 points incl. 3C or 3HC, 3 points.

Federation, 300 points incl. 4C or 4HC, 3 points.

Government, 500 points incl. 5C plus 5FS, 9 points.

Certificates will be awarded to members of 10-10 International who complete the Chapter requirements. This Chapter will also award an Associate Member Certificate to short wave listeners.

*First Country* will be awarded to the first correct application from each country including Australia.

*First State* will be awarded to each Australian state and territory, to each U.S.A. state, to each Canadian province, to each numerical call 0–9 in England and Japan, and to each 0–4 in New Zealand. Other countries will be processed accordingly.

*Honorary Charters* will be awarded at the discretion of the Chapter members and to government FS holders.

*Special Qualifiers* will be appointed to assist in propagating this award.

*Points Values:* Charters, 5 points (IQ); Honorary Charters, 5 points (IQ); Special Qualifiers, 5 points (IQ); First Country, 4 points; First State, 3 points; Local & DX, 2 points; and FC and FS on endorsements, 3 points. Special Qualifier can be used to substitute for Charter or Honorary Charter or First Country or First State.

Cost: Basic certificate $2.00 local, $3.00 DX. All endorsements $1.00 local, $1.00 DX.

*Net Frequency:* 28585 Fridays at 2300Z, Saturday 10 a.m. local.

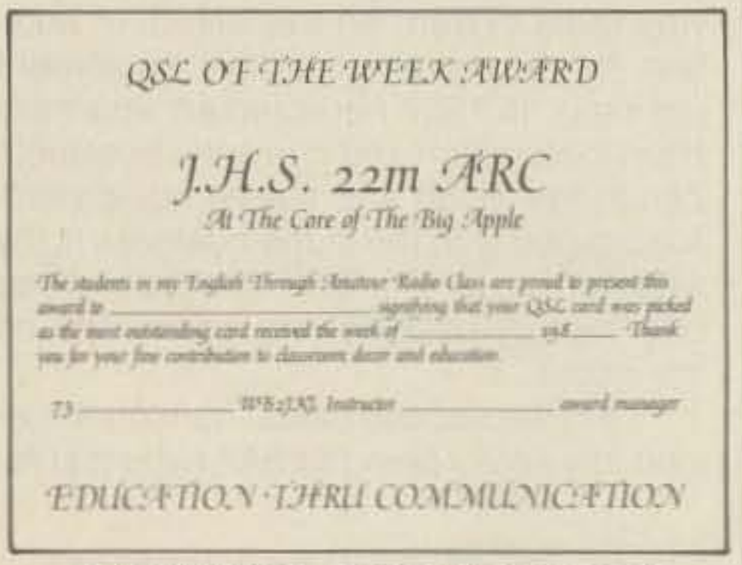
Send all correspondence to: Certificate Manager, P.O. Box 36, Cook A.C.T. 2614, Australia. (Thanks to John, VK1KJC, for this data.)

**QSL of the Week Award:** Issued by Joseph J. Fairclough and *the kids* at J.H.S. 22 M for QSOs with WB2JKJ, but I better let Joe tell the "story."

"I am a junior high school English teacher and have been since 1968. I've been an amateur operator since 1962. After several years of using the conventional methods of teaching English and finding they simply do not work on the 7th and 8th graders I'm dealing with, I decided it was time for a change. There had to be a better way. If a child is interested and *wants* to be in school, he or she will learn.

"With the idea of creating interest and excitement, I took the standard English curriculum and revised it all around ham radio. Very basically and briefly, this is what I developed:

1. Teach the children Morse in the be-




*WB2JKJ QSL of the Week Award.*

ginning of the term and get them to a point where they can copy their spelling and vocabulary in c.w.

2. Use the Novice handbook as the class textbook. Diagram its sentences, examine its parts of speech, etc.

3. Reading assignments from *QST, CQ, 73,* and any other suitable articles. Obviously, there is a great deal more, such as QSLing, letter writing, geography, math, speech, and on and on . . . .

"Above all, I try to instill respect for others and oneself and courtesy to all. Our program receives no funds from any Government agency or even the school itself. We are totally self-supporting. All our equipment was purchased from the fund-raising efforts of the students and myself. I must admit that it is difficult to survive this way, but it makes for a great spirit of everyone pulling together, and besides, hams are great people; without them, none of this would be possible.

"So listen for us on the bands. We'll be listening for you." For more information, write to Joseph J. Fairclough, WB2JKJ, Instructor, Junior High School 22 ARC, 111 Columbia Street, New York, NY 10002. *(Note: they will accept donations—ed.)*

## Notes

Guess I had better give some good news before I mention any sad news.

I nearly overlooked the information about Ron Toller, W4MNZ, who has All Counties #219 3-21-79. He recently upgraded his USA-CA-500 to read All 2× S.S.B. and All Mobiles on three bands: 20, 40, and 75. He also added All 20, All Mobiles from USA-CA-1000 through USA-CA-2500.

Recently I received the latest (9th edition) of the *County Hunter Handbook* put out by B & B Shop, 1348 Pinewood Drive, Woodbury, MN 55125. The cost is $2.50, and it is full of important information for County Hunters. They also sell special County Hunter QSL cards and other booklets to help County Hunters.

Sad to report the passing of another friend (not a County Hunter), Bernie Stahl, W2HL, who worked for many years at Radio Station WHN of New York City with friends like G5AFA, W1WY, W2AHW, W2BO (silent key), W2GT, W2IBC, W2KL, and WA4UOR. Three of us (W2HL, W1WY, and W2GT) recently received our QCWA 60 year awards.

Of course, these days the cost of everything goes up, and the *CQ* All Counties Award is no exception. By the time you read this, the cost will go from $35 to $40.

Although this is being written in September, by the time you get to read it, it will be the time to be jolly. So to all, a very, very Merry Christmas, and just because you do not get a card from me, do not feel that I have forgotten you. It is just impossible for one person to do everything.

73, Ed, W2GT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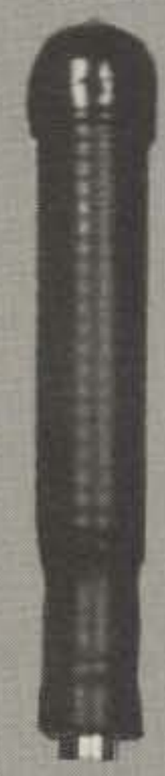

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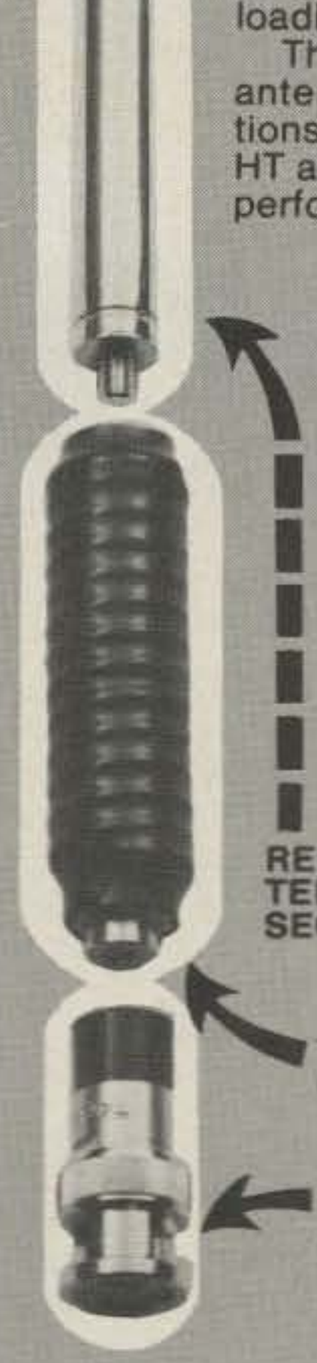


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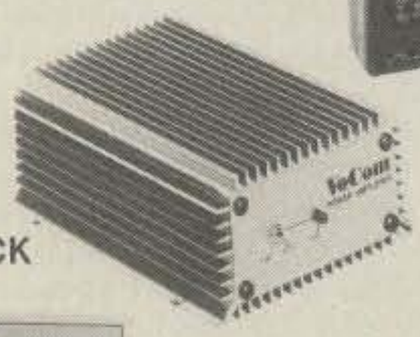

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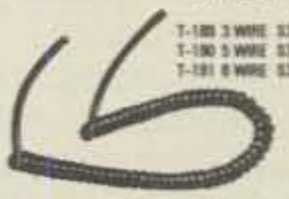


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# LAST-MINUTE HOLIDAY GIFT IDEAS

Well, what do you know. It's the holiday season again, and it's time to leave those helpful hints around the house so hopefully you can get what you really want this year. Socks just won't do it anymore, and the old flamingo tie is still good for a few more years and certainly doesn't need replacement. What's needed are the goodies that fit in between the equipment boxes (think big this year) that fill the empty spaces beneath the tree.

Books! Yes, books are the answer. No not *those* kind of books or the books that tell you how okay you are (you already know that) and how troubled *they* are (you know that, too), but rather books about the things that are contained in those equipment boxes we expect to be there. The following reviews are presented in order to help you fill out your list. You might even want to give one or two as presents (after you read them yourself, of course).

## Antenna Theory—Analysis and Design

**By Constantine A. Balanis**
**Harper & Row**

Although this book is meant to be used as a college textbook for electrical engineering students, it has a very good mixture of both theoretical and practical material. While analytically detailed and very thorough, *Antenna Theory* is easy to follow and use, and it is ideal for self-study. The book begins with basic material, develops the underlying concepts needed for sequential topics, and then progresses to more advanced methods and systems configurations. Each chapter is divided into sections or subsections the individual headings of which clearly identify the antenna characteristic discussed. Also, the book is full of examples, design data, references, and assigned problems. FORTRAN computer programs are also printed at the end of many of the chapters.

Of interest to the radio amateur are many three-dimensional computer-generated graphic illustrations for a clearer view of radiated fields and to better understand the underlying principles of radiation. Also, matching techniques such as the binomial, Tschebyscheff, "T," gamma, and omega match are described and analyzed. Design procedures (along with examples) are outlined for each type of matching system.

Log-periodic dipole arrays and Yagi-Uda arrays are described and analyzed in detail. Complete design procedures are outlined for both of these types of antennas. Information from many sources is included, such as Peter P. Viezbicke's "Yagi Antenna Design," NBS Technical Note 688.

Microwave antennas are covered in great detail. These include antennas such as rectangular and circular apertures; microstrip antennas; various types of horn antennas; plane, corner, parabolic, spherical reflector antennas; and lens antennas. The book also contains a detailed chapter on antenna measurements, including information on antenna ranges. At the back of the book is a set of appendices. These include tables of Cosine and Sine integrals, Fresnel integrals, Bessell Functions, and other indentities and functions.

*Antenna Theory* can be obtained from Harper and Row, M. Gonsky, Suite 5D, 10 E. 53rd Street, New York, NY 10022. The book is 790 pp. Price is $39.50 plus postage and handling.

**Roger A. Cox, WBØDGF**

## Radio Handbook, 22nd ed.

**By Bill Orr, W6SAI**
**Howard W. Sams and Co.**

The impression one gets from a price of $39.95 is that even in these days of inflation that cost should entitle you to a veritable encyclopedia. Fortunately, that is exactly what you get. One thing this well-known author cannot be accused of is a lack of completeness. Since this is the 22nd edition, there has been sufficient time to work on the selection of contents, and while you might be a bit disappointed at the depth of certain sections, the material is there, although you might have to work a little to find it.

Chapters 1 through 6 introduce amateur radio and basic electronic concepts. There is just enough in each section to answer the most commonly asked questions as well as to prepare the reader to go on to a more advanced book if further depth is needed. Unfortunately, the mix of old and new in these chapters is a little confusing. Selection of a 2N168 for a circuit example should have been updated to a newer and more obtainable transistor, and similar comments can be made on spending space on RTL as a logic system.

A highlight of the book begins in Chapter 7, which describes r.f. power amplifiers. This material in combination with 136 pages in Chapter 21 is probably one of the most complete reference works on power amplifiers and design examples available and will very likely save the home brewer or ham repair person many hours of looking for material in back issues of magazines or manufacturer's literature.

There is again a mixed blessing in terms of material selection. The venerable and much beloved 813 is used for a very complete design example in place of a more modern tube. However, the portions devoted to solid-state amplifiers more than make up for this deficiency, although you have to hunt for the v.h.f. solid-state power amplifier material under "Mobile and Portable" in Chapter 19.

Special processing circuits, synthesizers, and receivers are well treated. A clear and readable section on the mysteries of dynamic range, intercept point, *et al*, is one of the better parts of the book. Solid-state power supplies are also well treated, but one could question why so much space was devoted to mobile power supplies for tube-type finals, since this reflects the state of amateur radio in the 1960s and 70s, not the 80s.

The sections on radiation, propagation, and antennas are again brief but good. Occasional editing difficulties, such as placing a figure two pages away



Say You Saw It In CQ

from the corresponding text (Chapter 31), should not discourage you from considering this book for your shelf.

The phrase "brief but good" applies to most of the book. You will probably want more information on any single topic you might be interested in, but perhaps to supply that in one book the price would have to go from $39.95 to a much higher figure, which might place this encyclopedic work out of the reach of many amateurs.

The *Radio Handbook* is available from *CQ* Book Shop. The price is $39.95 plus $2.00 shipping and handling.

**Paul M. Danzer, N1II**

## HF Antennas for All Locations

**BY L.A. Moxon, G6XN**
**RSGB**

So, you want to put up a vertical antenna, but there's no place for a decent set of radials? Or the rental store called the XYL the day before she left to visit her mother to ask when you wanted the chain saw delivered? You say your recently departed uncle left you six B-I-G ones, and you can't decide whether to buy the Okefenokee Swamp or Pike's Peak for your dream antenna farm? Or the kid down the block ate your lunch all over 15 meters in the recent DX contest? And he was running barefoot? Is that what's troubling you, Bunkie? Well, cheer up, fellow; help is on the way from our British cousins at the RSGB in the form of a new book, *HF Antennas for All Locations* by Les Moxon, G6XN. This book celebrates the art of the possible in high-frequency antennas, and is sure to find an important place on the bookshelf of any amateur interested in high-frequency operating.

This is an eminently practical book designed to help optimize your signal on the high-frequency amateur bands, especially where money, XYL's, neighbors, or zoning ordinances are real considerations and limitations. It is written from a European perspective—tiny lots, heavily urbanized areas, and variances required for anything more substantial than a TV antenna.

Yet, clearly, the author, like any good amateur, can dream, because time is spent carefully analyzing the characteristics of the ideal QTH. Consideration is given to subjects such as angle of radiation, ideal antennas for the ideal QTH, grounding, etc. The author has proven many of his theories with practical work as well, using QRP rigs backpacked to apparently ideal locations to give them a try. Instead of the usual "I got a 5 × 7 running my 8877 wide open," Mr. Moxon regales us with tales of long-path QSO's into Australia from England via the Long Path, running 1 or 2 watts into temporary antennas.

The book is full of practical antennas, many common on our side, but also some hardly known at all. And they are considered in real terms—in the environment that they are likely to be erected in. For example, how do trees affect your signal, wet or dry? The answers are here, and even advice on optimizing your signals in trees. There is excellent coverage of invisible antennas, mini-antennas, apartment antennas, and many varieties of wire antennas. Phased arrays, such as 8JK's and phased verticals, are well covered.

The book reflects a somewhat different tradition in antenna design from contemporary American publications. Yagis are rather lightly treated, probably because the author feels that they are adequately covered elsewhere. Some of the material will definitely be considered controversial. For example, traps get short shrift in favor of linear decoupling techniques, including use in wire antennas. More shots are fired in the Quad vs. Yagi wars. Antennas virtually unknown in the States are offered for consideration in situations where we would definitely favor a Yagi.

Parts of the book get somewhat technical, but in most cases where this occurs, Mr. Moxon recognizes that not every one is into heavy math, and he offers conclusions in a simplifed, readable way.

If you are a "Pair of matched 8 element Yagis on 67 foot booms, stacked, with half-wave phasing, on a rotating 140 foot tower" person, then this book is not for you. But if that description does not fit you, and you operate the high-frequency amateur bands, then this is an important book for your shelves.

*HF Antennas for All Locations* is available from the ARRL at a cost of $12.00.

**Bob Locher, W9KNI**

## Android Design

**By Martin Bradley Weinstein**
**Hayden Books**

Marty reaches deep into his bag of technical and engineering tricks in *Android Design*. This is not a Heathkit-style project or a follow-these-plans book. It's a book about how to design things that involve electronics, mechanics, and people. The chapters on batteries and heat sinks alone justify its inclusion on any amateur's bookshelf. However, his bag of tricks runs deeper than that.

Imagine a slow scan camera based on a $20 circuit! The imaging device is a common dynamic RAM memory. Marty calls it a "ramera," described in a chapter that discusses android vision.

When's the last time you tried to motorize anything, be it a tower crank, antenna rotator, moonbounce elevator, or whatever? Marty's chapters on motors and motor drives take a lot of the mystery out of these projects.

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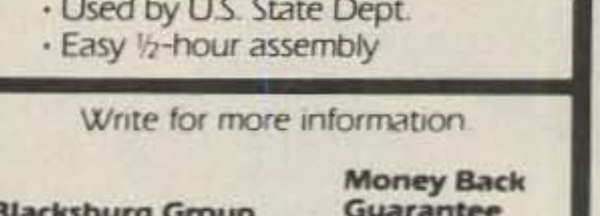

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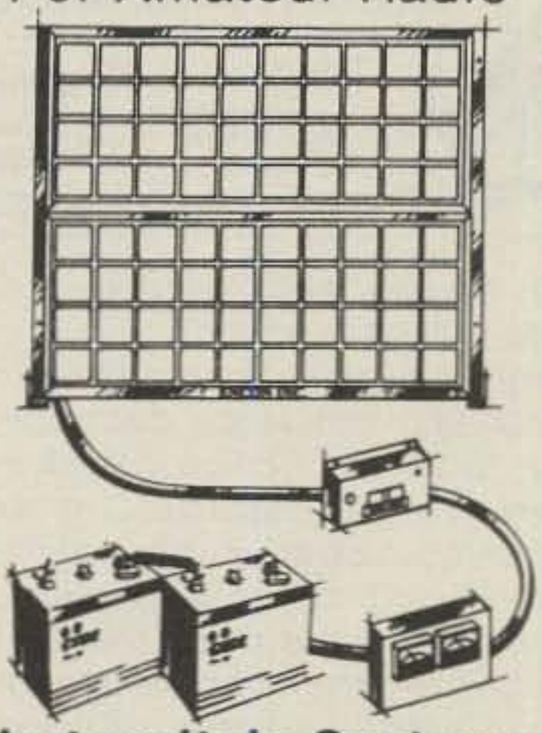

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plus houses and dealers—are listed along with each topic.

For handicapped hams, the discussion of collision avoidance discusses many ways to put electronics to work inexpensively to locate obstacles. Infrared light and ultrasonics are just two of the topics covered, with circuit descriptions.

In short, this is much more a how-to-design than a how-to-build book. And you don't have to be planning on having a mechanical man running around to get a lot out of it. As is the author's style, the text is easy-reading and filled with MBW-isms and anecdotes.

It's available for $11.95 at many bookstores, including Waldenbooks. If not immediately available, it can be ordered through the store (Hayden #5192-1) or directly from Hayden Publishing (50 Essex Street, Rochelle Park, NJ 07662).

**Alan M. Dorhoffer, K2EEK**

## Getting Publicity

**By Martin Bradley Winston**
**John Wiley & Sons**

This is probably one of the best books of its kind available anywhere. As much as it's simply written—even a raw beginner could get results by following the book's advice—it includes insights and tricks of the trade that are of value even to seasoned professionals. For your club or your business, it's hard to imagine *not* getting a lot out of *Getting Publicity*.

Marty explains what publicity is—and isn't—and the kind of news coverage (and other things) that can result from it. He gives an accurate and insightful description of what editors and other people at the "far" end of the publicity channel are like. He describes everything you need to have or get or do in order to produce publicity. And he tells how to get it done.

Everything's covered from writing and photography to printing and mailing. Marty even starts earlier with important advice on planning and researching (which is easier to do, thanks to his tips, than it sounds) and later goes on to tracking results and following up.

The book is full of examples and exercises. You'll see how professionals like Radio Shack, Sears Roebuck, and Motorola send out materials. You'll even learn how a magazine like *CQ* responds to publicity—or doesn't.

This is must reading for everybody who owns or runs a business, big or small, and for people who want to do a better job of getting club activities into the news.

*Getting Publicity* (ISBN 0471-08225-2) is available at most book stores for $8.50, or write to John Wiley & Sons, 605 Third Avenue, New York, NY 10158.

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**By Oliver P. Ferrell**
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# The World of Video

*a monthly feature by*
**DAVE INGRAM, K4TWJ**

A LOOK AT THE WORLD AROUND US

## *Satellite TV Update*

That festive time of year is here once again, and we would like to encourage all of you to take out at least a brief amount of time from "all business" activities to enjoy some on-the-air holiday exchanges. Each December both newcomer and old-time Slow Scanners have traditionally joined the operating excitement and exchanged video greeting cards via the h.f. bands. The usual gathering spots are our long-established SSTV frequencies: namely, 3,845, 7,171, 14,230, 21,340, and 28,680 kHz. This is an ideal time of year to renew friendships, put a face behind that voice heard so many times, and lay groundwork for visual recognition at Dayton '83.

### More Robot 400 Mods

Following on the heels of last column's 256-line adaptations for the Robot 400, we've included another mod for your soldering-iron activities this month. Thanks for this information again goes to WA7WOD and KD6HF. The number of improvements for this popular unit are happening so rapidly that we're tempted to suggest replacing top cover screws with quick-off snap fasteners. Might unmodified Robots soon become collectors items?

This relatively simple modification provides black-and-white compatible viewing of increasingly popular single-frame color SSTV transmissions (25 second Interface Systems format). The schematic diagram should be relatively self-explanatory (see fig. 1). Another switch, mounted on the front panel or outboarded in a separate minibox, will be required. Simply label the switch "8 second pictures" and "25 second pictures" and use accordingly. Essentially, this modification (which operates with both 1:1 and 4:3 aspect ratios) permits full-screen display of a color transmission's "green frame" video. As a direct comparison/explanation of the modification, during 25 second color Slow Scan transmissions, 256-line-modified Robots display three elongated pictures horizontally across the screen while the 25 second mod causes display of a single and full-sized picture encompassing the full screen area. "Stock" Robots display 25 second views in three somewhat elongated parts: top of picture, middle, and bottom of picture. Add a couple of drinks to late-night viewing, and it should prove a real blast, eh?

### Looking at Single Frame Color

A number of exciting and encouraging activities have been happening lately in the area of real time, or Single Frame, Color Slow Scan. Two slightly different systems have begun rising in popularity, and their signals are being heard on the air quite frequently. As a means of simplifying discussion, we'll designate the system simply as the "Interface Systems Single Frame Color" and the "WØLMD Single Frame Color." Although neither system offers direct and full compatibility with unmodified SSTV gear, their orientation toward digital rather than analog concepts (time multiplexing rather than frequency multiplexing) can permit that capability at minimum expense and effort to "stock SSTV system" owners. An outline/analysis of the two Single Frame Color concepts is shown in fig. 2.

The Interface Systems Single Frame Color employs approximately 384 scanning lines which are transmitted during a 25.5 second period. Line information alternates among red, green, and blue video which, at the receiving end, is directed to the appropriate color memory. (Interface Systems, you'll recall, produces the popular triple memory Sequential Frame Color modification units for Robot 400's. A very simple modification can be added to those color units for Single Frame Color operation.) The overall results are thus 128 lines of red video, 128 lines of green video, and 128 lines of blue video, which are used to provide a single full-color frame in 25 seconds. Black-and-white compatible viewing is provided by scanning/storing/viewing every third line following the first (red) line or the green video lines. That black-and-white compatible mod is included in this month's

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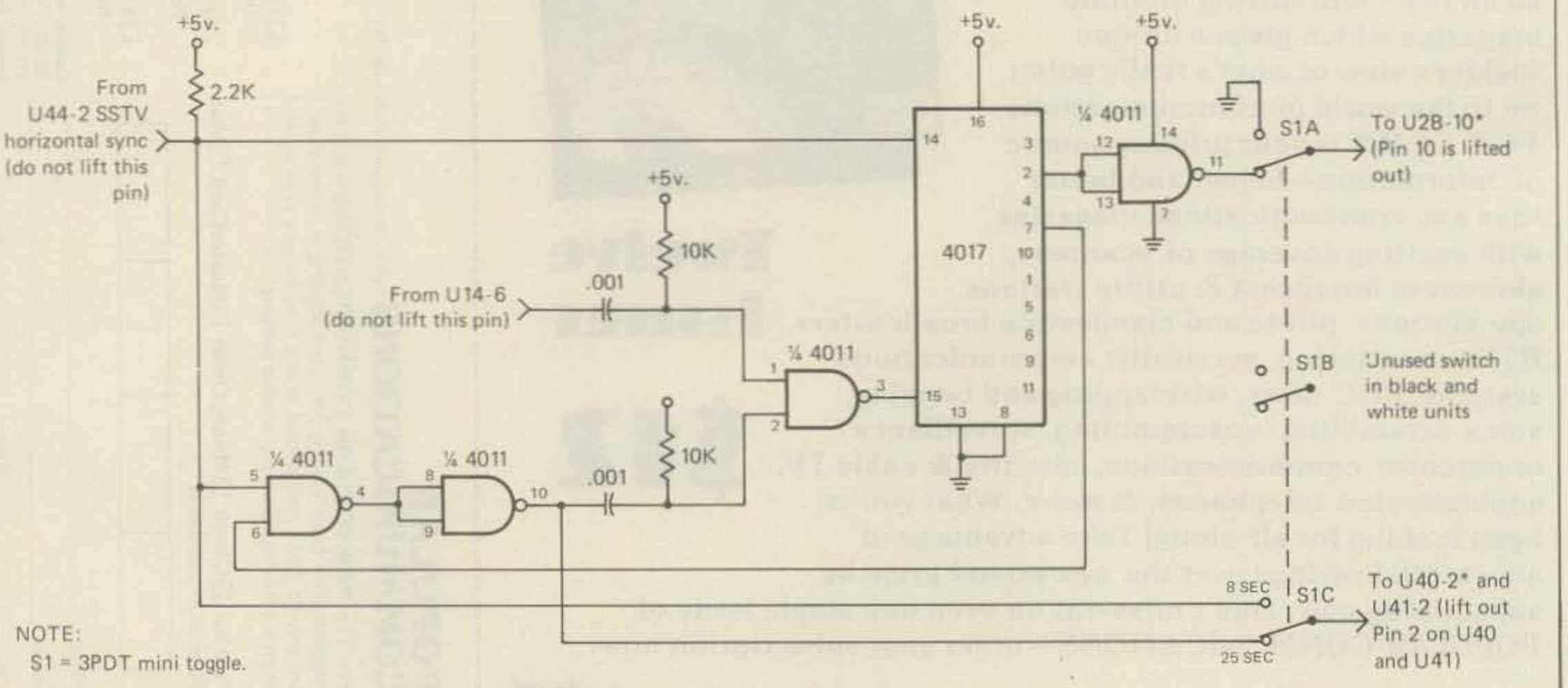


*Fig. 1– Single Frame Color mod for black-and-white Robot 400 for copy of green frame 25.5 second.*



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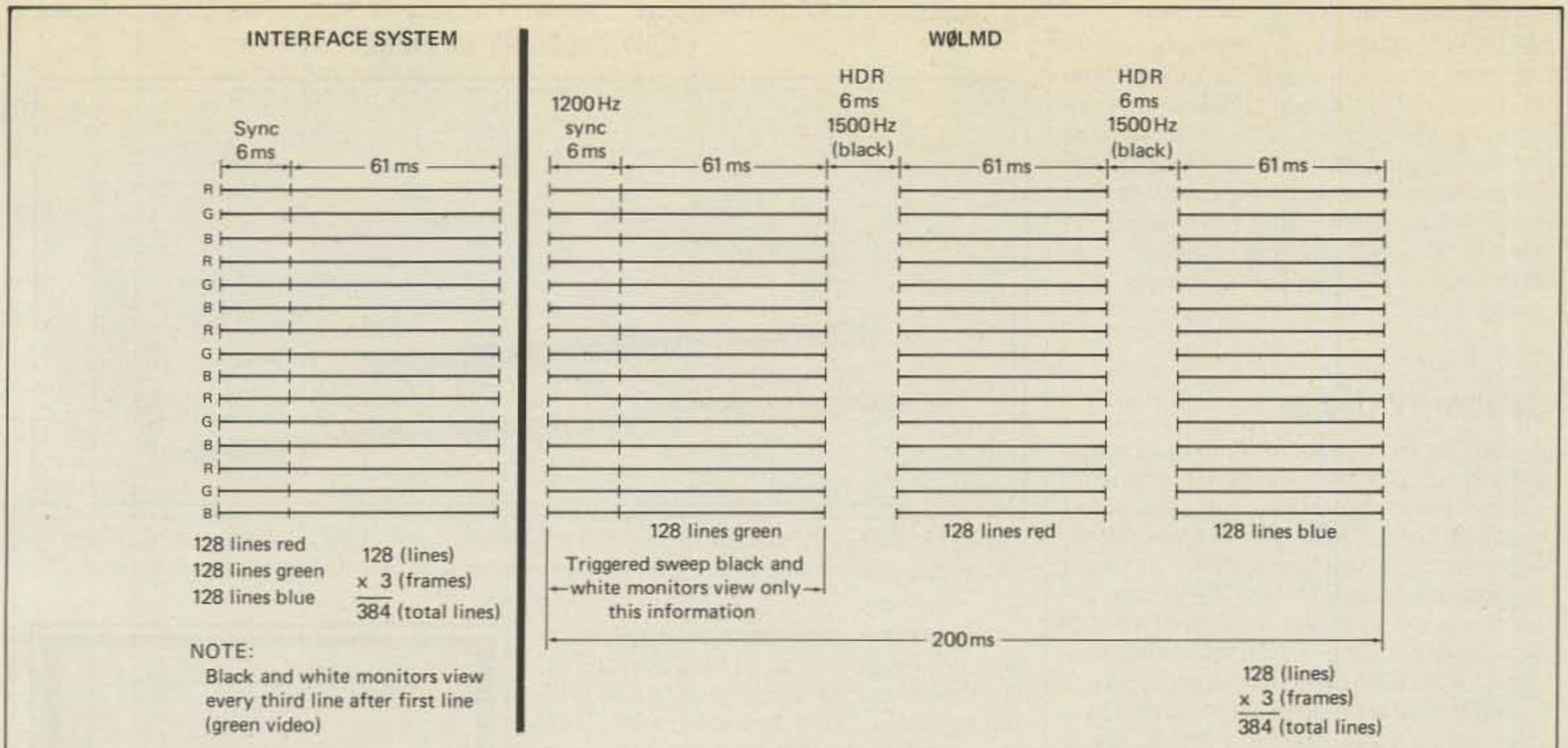


*Fig. 2– Direct comparison of the Single Frame Color SSTV systems of Interface Systems and WØLMD. Both arrangements employ 384 lines and 25 second time periods, but the concepts are slightly different. (See text for details.)*

column. It is also interesting to note that 256-line capable scan converters can be used to produce three rasters across the screen, and these rasters will each contain 128 lines of red, green, and blue video, respectively.

The WØLMD Single Frame Color in its present form also employs approximately 384 scanning lines which are transmitted during a 25.5 second period, but in a slightly different manner. As illustrated in fig. 2, only 128 lines (the green frame) are preceded by a sync pulse in this system. The red and blue frames are preceded by computer-type headers which are ignored by black-and-white units, but are used by digital circuitry in color units to control loading of associated information into the proper memory. The overall results are again 128 (lines) by 3 (frames) to provide a single color picture in 25 seconds. Black-and-white compatible viewing is afforded by use of a triggered sweep SSTV system, which responds only to sync pulses and related 61 millisecond lines of green video. The WØLMD system also produces some interesting effects when viewed on conventional (black-and-white) 128- and 256-line Robots. Add another couple of drinks to the previously mentioned late-night viewing, and you should be seeing pictures in all directions!

Dr. Suding is considering the possibilities/benefits of reducing time periods of red and blue lines for providing 12 second (and maybe later 8 second) Single Frame Color. Since color TV proportioning is made up of 59 percent green, 30 percent red, and 11 percent blue, reduction of red and blue information holds merit. As an example, visualize retaining 61 milliseconds for green lines, but reducing red lines to approximately 22 milliseconds and blue lines to approximately 9 milliseconds. The Single Frame Color time decreases to approximately 12 seconds. An 8 second Single Frame Color picture obviously would require "pulling some milliseconds" from the green picture's right side for conveying red and blue information.

As mentioned previously, the two systems are not directly compatible, but they are interesting to contemplate. A fairly large number of the Interface Systems units are presently in operation. These units use the R, G, B sequencing established several years ago. Conversely, the

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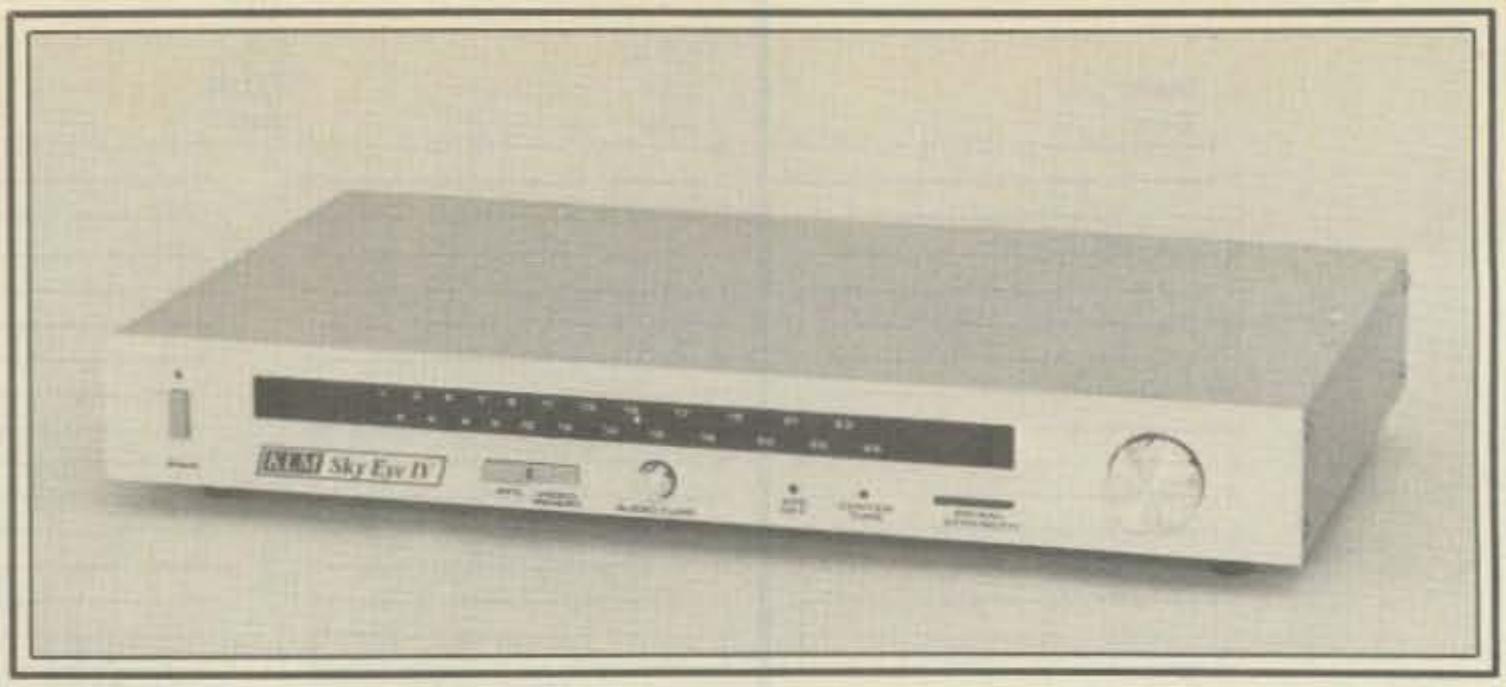

*The KLM Sky Eye IV satellite receiver includes smooth tuning, S meter, AFC, video invert, and a reasonable price. Can be purchased with or without modulated oscillator.*

W0LMD unit requires first-frame transmission of green video. Circuit boards and systems for this unit are being developed at the present time. Utilization of modern digital techniques in both systems, however, means flexibility can be achieved at a later date. Meanwhile, be alert to "unusual displays" on your black-and-white units. They are merely progress. Enjoy!

## Satellite TV Update

Judging by the vast number of individuals setting up home satellite TV receivers, we can truthfully say that this latest video craze has reached epidemic proportions. More than a few small-time amateur equipment suppliers and TV repair enthusiasts are vying for a piece of this action and bringing home a reasonable amount of extra coins in the process.

Setting up a satellite TV receiving system isn't overly difficult—especially if you've been through the process once or twice with a "veteran installer." A dish location providing unobstructed view of the sky from south at approximately 40 degrees elevation to west at approximately 25 degrees elevation (depending on one's exact location in the U.S.) is the first consideration. This "clear view" step is vital; some cases may require renting a chain saw and clearing a few trees. KLM Electronics (P.O. Box 816, Morgan Hill, CA 95037) has a site survey kit available which is quite helpful. This kit lets you see the sky exactly as the planned dish will see it—along with any obstructions. The survey booklet also includes other ideas, such as cabling plans, dish site accessing, etc.

The next step involves setting the parabolic dish's mount in concrete at the selected site and mounting the dish proper. In order to accurately track all satellites in the "belt" (called the Clarke belt, in honor of its 1940s envisioner), a polar mount is used. This moves the dish in azimuth and elevation simultaneously, and it must be accurately orientated with respect to true north/south before the concrete dries. Parabolic dishes, being too large and heavy for shipping via conventional means, usually require trucking from the factory to city of installation. On-site assembly of the parabolic dish and its placement on the mount requires muscle power—a good time to invite friends for an afternoon's fun and fritters.

Finally, the LNA (Low Noise Amplifier) is installed at the dish's focal point, hardline cabled to a nearby 4 GHz to 70 MHz downconverter, and connected to the satellite TV receiver via a length of RG59 coax cable. That receiver's (r.f.) output connects to the antenna terminals of the viewing TV set. During initial checkout, we suggest moving all indoor gear to the dish site proper. Watch for elusive grounds with a.c./d.c. TV's, and then fire up the whole system. Point the dish in the direction of a known operational satellite (azimuth), and then with the receiver set to a known transponder, raise dish elevation until a signal is acquired. After "tweaking" everything for the best reception, we suggest wrapping all weather-exposed connections with the new "Coax Seal" you've seen advertised lately and mounting the downconverter in a weatherproof enclosure.

The KLM Sky Eye IV receivers and associated remote downconverters have proven to be outstanding performers. During the last couple of months, we've followed several hundred of these units being placed in use and their proud owners going half blind with all the exciting TV viewing. Couple these units with a 120 degree Avantek LNA, and you have a winning combination for personal use—or for installing for others and earning a creditable sideline income.

Enough, enough. Once again, we've run out of space for happenings in the world of video. Enjoy the on-the-air happenings during this festive season, and we'll continue the discussions next month. Merry Christmas!

73, Dave Ingram, K4TWJ

One of the hottest items on the present satellite TV scene is KLM Electronic's Sky Eye IV 3.7 to 4.2 GHz receiver and mating dish-located downconverter. This little gem gives an in-home appearance similar to modern "low boy" stereos, while providing doggone good reception of the TV satellites. The slide-rule dial and flywheel knob have a feel like a National 300 receiver. There is separate audio tuning for "oddball" transponders, an LED type S meter, and video invert for "upside down" signals. As an experiment, we placed the downconverter and receiver 30 or 40 feet from the 13 foot dish and ran plain RG59 cable from the 120 degree LNA to the downconverter (a lossy arrangement that's asking for problems). The system worked great with only a slight trace of noise (sparkles, as they're called). Nice.

Another hot item of interest to home video enthusiasts is KLM's new 11 foot parabolic dish and polar mount. A collector plate is situated at the dish's focal point directing received signals into the support tube (waveguide). A magnetic assembly within that weatherproof section selects either horizontal or vertical polarization and directs that energy into the LNA, which is mounted near the dish end of the tube. A neat, efficient, and rugged setup.

The polar mount includes a DC motor with reduction gearing and a stainless steel chain drive. Talk about husky! The whole setup gives remote-control dish movements for an ultimate system. Now that's going first class! For more information on either of these items, contact KLM Electronics, P.O. Box 816, Morgan Hill, CA 95037.

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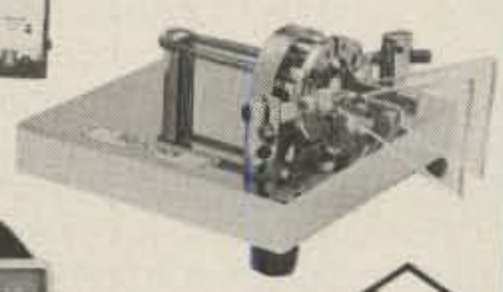

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THE INS AND OUTS OF THE WASHINGTON SCENE

## President Signs 1982 FCC Revision Act

On 13 September 1982, President Reagan signed H.R. 3239, the 1982 FCC Revision Act, into law, thereby bringing sweeping changes into the electronics community, in general, and the amateur service, in particular.

The new law contains several sections on matters pertaining to radio-frequency interference (r.f.i.) and amateur participation in licensing and enforcement activities. Incorporating both Senate Bill S. 929 (the so-called Goldwater bill) and H.R. 5008, its counterpart in the House of Representatives, H.R. 3239 contained the following provisions (among others):

**1.** The legislation clarifies the FCC's exclusive jurisdiction on matters involving r.f.i.. This provision is best explained by reviewing the Joint Explanatory Statement of the Committee of Conference (as published in Vol. 128, Congressional Record, page H 6538):

"The Conference Substitute is further intended to clarify the reservation of exclusive jurisdiction to the Federal Communications Commission over matters involving RFI. Such matters shall not be regulated by local or state law, nor shall radio transmitting apparatus be subject to local or state regulation as part of any effort to resolve any RFI complaints. The Conferees believe that radio transmitter operators should not be subject to fines, forfeitures or other liability imposed by any local or state authority as a result of interference appearing in home electronic equipment or systems. Rather, the Congress intends that regulation of RFI phenomena shall be imposed only by the Commission."

With the signing into law of H.R. 3239, it appears that local r.f.i. ordinances such as have been enacted in a number of communities (including Burbank, IL) will not be enforceable in the courts.

**2.** The legislation is, in effect, "enabling" legislation on r.f.i., in that it authorizes the FCC to impose minimum r.f. susceptibility standards for home electronic equipment and systems.

**3.** The new law permits volunteer examiners to administer amateur operator license examinations.

**4.** The new law exempts the amateur service from the secrecy provisions of Section 605 of the Communications Act, thereby encouraging self-enforcement of the service's Rules.

Amateurs everywhere owe a debt of gratitude to the ARRL, and in particular to Messrs. Vic Clark, W4KFC, Chris Imlay, N3AKD, and Perry Williams, W1UED, for their tireless efforts to secure passage of S. 929 and H.R. 5008, and of H.R. 3239. Also playing a key role in seeing these bills through Congress was Mr. David R. Siddall, K3ZJ, President of the Capitol Hill Amateur Radio Society. We are, of course, most grateful to Senator Barry Goldwater and Representative William Dannemeyer for introducing and supporting the original legislation on r.f.i. and on amateur licensing and enforcement activities into the 97th Congress. And finally, we gratefully acknowledge the support of Mr. James McKinney (Chief, Private Radio Bureau, FCC), Mr. Richard Smith (Chief, Field Operations Bureau, FCC), and the current Commission, all of whom had the foresight and the conviction to seek such legislation in the face of strong opposition from this country's electronic home-entertainment industry.

### FCC Chairman Fowler Directs Staff to Consider Early Authorization of 10 MHz Amateur Band

Following a letter from Senators Barry Goldwater and Harrison Schmidt urging FCC Chairman Mark Fowler to take immediate action to " . . . provide interim operating authority for use of the 10 MHz band," the Chairman instructed his staff to revise their approach and to prepare for consideration of two related matters late in 1982: **(1)** A notice of Proposed Rulemaking, proposing the implementation of the Final Acts of the 1979 WARC; and **(2)** A review of the request for amateurs to gain early, temporary access to the 10 MHz band under Section 115 of the Radio Regulations.

Part 115 of the Radio Regulations provides for temporary operations in bands not allocated to the user provided that such operations do not interfere with stations authorized to use the band. In the case of the 10 MHz band, some Fixed service operations can still be found on the frequencies which will eventually be turned over to the amateur service. Until these Fixed stations vacate the band, however, they have priority over any amateur activities performed under Part 115 of the Rules. It is probable that both matters will be before the Commission as this is read.

### FCC Acts in Amateur Matters Pertaining to Digital Codes and Power Output Measurements

The Commission, in September 1982, acted on two matters which had been pending before it: **(1)** The use of non-standard digital codes at frequencies above 50 MHz; and **(2)** The use of peak power output measurements versus the current use of average power input measurements to determine an amateur transmitter's power setting.

As regards digital codes, the Commission *adopted* Docket No. 81-699, thereby permitting amateurs to use virtually any code of their choice at frequencies above 50 MHz. As was expected, some concern was expressed within the Commission on the conflicting desires to encourage experimentation while, at the same time, to permit a signal monitoring for enforcement purposes.

The need to monitor amateur experiments involving the use of non-standard codes, however, did not appear to be critical since:

**1.** An amateur operator thought to be violating the Commission's Rules can be ordered off the air by the local engineer-in-charge until such time that an investigation of the matter can be completed.

**2.** Amateurs will be required to keep records of the codes they use, and these records must be made available to the Commission on request.

**3.** The amateur service's record on self-policing suggests that enforcement of this Rule will not present a problem.

The Commission also acted to provide larger communication bandwidths for computer-to-computer interchanges.

Turning to the area of power measurements, the Commission *adopted* an item which called for the release of a Notice of Proposed Ruling Making (NPRM) on the use of peak power measurements in the amateur service. The docket, No. 82-624, proposes to substitute peak power output measurements (obtained with a peak-reading meter) for the current requirement to measure average power input. The NPRM would also propose to delete

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the requirement that an amateur running in excess of 900 watts input be required to have an accurate means by which to measure power input. The Commission will *not* propose that amateurs possess peak-reading power meters; rather, it will propose that the Commission define the type of peak-reading meter it will use in making such measurements for enforcement purposes.

The NPRM on the use of peak power output measurements in the amateur service was to have been released in October 1982.

## U.S. Broadcasters Accuse Cuba of Starting Radio War

According to stories appearing in *The Washington Post* and *The Wall Street Journal*, broadcasters across the country have accused the Cuban regime of starting a "radio war" in the a.m. broadcast band. The accusations arose because Cuban broadcasts, on 31 August 1982, interfered with at least five—and possibly six—a.m. frequencies used in the U.S. One of the frequencies blocked was that occupied by WHO, Des Moines, IA, at 1040 kHz.

The intentional interference to WHO is believed to have been done in retaliation against the Reagan Administration's proposal to begin operations of Radio Marti on 1040 kHz. Once operational, Radio Marti, a news and information station, will be used to beam pro-West broadcasts to Cuba.

In addition to interfering with WHO, which is a clear-channel station, the Cubans also caused interference to WMAQ-AM (Chicago, IL; 670 kHz) and KSL (Salt Lake City, UT; 1160 kHz); both are clear-channel stations. Interference was also noted on 570 and 1380 kHz, two frequencies used as regional channels around the U.S.

## Radio Moscow Broadcasts on Top of WWV

*Monitoring Times* also noted recently that in May 1982 Radio Moscow's Havana, Cuba, relay station began broadcasting on 10.000 MHz. Readers will recognize this frequency as one of the frequencies used by WWV, the National Bureau of Standard's station used for time and frequency control.

The FCC apparently had no explanation for Cuba's action. However, *Monitoring Times* hypothesized that with the impending operation of Radio Marti (1040 kHz), an anti-Castro station recently approved for operation by the House of Representatives, tempers in Cuba are beginning to wear a bit thin.

## Senate Approves Funding for Radio Marti

Following a heated debate, the Senate, in mid-September, voted to fund Radio Marti, an anti-Castro a.m. broadcast station to be built in Florida. The vote followed a last-minute effort by Representative Pell (D.—RI) which would have substituted expanded Voice of America (VOA) broadcasts to Cuba for Radio Marti's. Pell felt that using VOA broadcasts would be less confrontational. Representative Percy (R.—IL), however, felt that use of the VOA would hurt that organization's credibility by making it a propaganda agency.

Because of the fear that Radio Marti's operations will result in retaliation from Cuba, the National Association of Broadcasters is lobbying against the creation of the new station. Radio Marti is to operate on 1040 kHz, and indications are that Cuba has already started to interfere with U.S. broadcasts on this and other frequencies to show its displeasure.

The problem of Cuban interference was taken into consideration during the House and Senate debates on Radio Marti, with the Congressional Budget Office presenting data which showed that more than 200 a.m. stations operating in 32 states could have their broadcasts disrupted by Cuban interference.

## FCC's Review Board Affirms Actions Taken Against Two Amateurs

The FCC's Review Board recently affirmed two judges' decisions in cases involving amateur operators.

In one case, involving Gary Kerr, WA6JIY, the Board affirmed a decision by Administration Law Judge Edward Kuhlmann which denied the license renewal of Kerr, Stockton, CA, for WA6JIY and for his General class amateur operator license. Kerr had been found guilty of intentionally and repeatedly interfering with a repeater station's operation.

Kerr claimed he had been conducting tests and was not deliberately jamming the repeater's operation. However, the Board said that FCC Rules do not permit tests of the type Kerr claimed to be running. It further noted that even a single instance of intentional jamming may result in removal of a license because of the seriousness of the offense and the harm such actions do to the public interest.

In another decision, the Board affirmed Judge Kuhlmann's decision revoking the station license and suspending the operator license for another Stockton, CA, amateur. In this case, Judge Kuhlmann found Donald Gilbeau to have purposely violated Commission Rules by transmitting unidentified jamming signals on the frequency used by an area repeater station in May 1980. Gilbeau admitted to making the transmissions, but said that he was trying to get even with others who had been jamming the repeater. Judge Kuhlmann had ordered Gilbeau's amateur Extra Class operator license suspended and his license for station N6OZ revoked.

The FCC Board, in reviewing the Gilbeau case, said that in light of Gilbeau's previously unblemished record as an amateur licensee, it was revoking his station license without prejudice, leaving Gilbeau free to refile an application for the license after the mandatory one-year waiting period.

## Slymar, CA, Amateur's Station License Revoked, Operator License Suspended

An FCC Administrative Law Judge revoked the license of Henry C. Armstrong III, Slymar, CA, for amateur service station WA6CGI. The judge also suspended Armstrong's Advanced Class amateur operator license. Both actions were taken because Armstrong was found to have willfully, and with malicious intent, interfered with the transmissions of other amateur operators.

Assistant Chief Judge Thomas B. Fitzpatrick, in an Initial Decision, found that Armstrong in 1980 had deliberately interfered with the transmissions to and from a repeater station operated by the Southern California DX Club. Specifically, Armstrong had caused the interference with the intent of driving the repeater off its input frequency of 144.88 MHz and out frequency of 145.48 MHz.

The Judge also found that Armstrong had tried to mislead the FCC with a "cover story" that he was engaging in legitimate testing of experimental equipment. The facts, said the judge, mandate revocation and suspension.

## Truckers Using Marine and Amateur Bands

According to an article in *Monitoring Times* (September/October, 1982), the nation's truckers are apparently setting up a mobile network on frequencies assigned to the marine community. The frequencies most often cited as being used by the cross-country haulers are 151.625 and 151.655 MHz.

It has also been learned that the amateur 2 meter band is popular with truckers. Here, the frequency thought to be used illegally is 145.550 MHz.

The illegal use of both the marine and amateur bands by the truckers results from the ready availability of mobile and hand-held transceivers for these bands, and from the crowded, interference-prone conditions often found on the 27 MHz CB channels.

## Radio Club of America Selects New Fellows, Including HB9RS

The Board of Directors of the Radio Club of America (RCA) selected 30 new Fellows who are to receive their certificates at the Annual Awards Banquet to

be held on 19 November 1982 in New York City, NY. Dr. Max C. de Henseler, a recipient of the grade of Fellow at this year's Award Banquet, will be the respondent for the new Fellows.

Amateurs know Max as HB9RS/2 and as the founder, president, and moving force behind the United Nations Amateur Radio Club (4U1UN). In the United Nations, Max is Chief of the Cartography Section.

Born in Geneva, Switzerland, Dr. de Henseler was first licensed in 1947, and through his travels he became the first amateur to work all continents from each of the six continents.

The staff of *CQ* and your Washington Editor extend congratulations to Dr. Max de Henseler on his election to Fellow in the Radio Corporation of America.

## Two Geosynchronous OSCAR Satellites Proposed for 1985 Launch

According to AMSAT Satellite Report, a Florida cable TV operator, Cablesat General Corporation of Cocoa, FL, has filed a comprehensive proposal with the FCC to place two domestic satellites (domsats) in geosynchronous orbit over the Western Hemisphere. Included was a proposal to include two C-band amateur radio satellite transponders in the domsat payloads.

The president of Cable General is Mr. Raymond A. Kassis, WA4OHK, and it is through his efforts that both Cablesat satellites may carry amateur transponders.

The two Cablesat satellites, scheduled for launch in late 1985 or early 1986, will be placed at both ends of the geosynchronous arc serving the Western Hemisphere. From these vantage points, the two "birds" will serve the entire continental United States, most of Canada and Mexico, and much of the Caribbean.

It should be noted that RCA's Astro Division, Heightstown, NJ, is behind the development of the commercial domsats. It is thought that several of the hams at Astro helped to write the proposal for the amateur transponders which accompanied the main proposal.

For more information on these proposed OSCARs and other activities of The Radio Amateur Satellite Corporation (AMSAT), interested readers may write to AMSAT, P.O. Box 27, Washington, DC 20044.

## New Civilian Uses for Spread Spectrum Modulation Developed

Writing in *AMRAD Newsletter* (published by the Amateur Radio Research and Development Corporation), Hal Feinstein, WB3KDU, recently noted that civilian applications of spread spectrum modulation are expanding. While initially developed for and used in the military to provide jam-resistant communications, spread spectrum is now finding its way into a number of areas, including, but not limited to:

- ranging (terrestrial and space use);
- satellite communications (spread spectrum's process gain is being used to offset the disadvantage of using smaller antennas);
- inter-computer communications (Hewlett-Packard is examining the possibility of using spread spectrum techniques to communicate by radio between a computer and its remote terminals);
- packet radio (AMRAD is looking into this aspect of spread spectrum applications, as are others);
- distribution of copyrighted material (cable operators are exploring the use of spread spectrum to transmit their signals in a way that prevents pirates from tapping the material).

If you are interested in spread spectrum modulation and techniques, contact AMRAD, 1524 Springvale Ave., McLean, VA 22101.

## Commission Again Clarifies Its Position on Amateur Rebroadcasts

In a letter to your Washington Editor, and as a result of inquiries by several readers of this column, Mr. Raymond A. Kowalski, Special Services Division, Private Radio Bureau, FCC, stated: "All forms of broadcasting by an amateur radio station are prohibited by Section 97.113 of the Commission's Rules."

Mr. Kowalski also provided a copy of a Commission Order, adopted 30 January 1980, which addressed amateur rebroadcasts. This Order states, in part:

"The major reason for retaining the prohibition (against rebroadcasting by amateurs) rests in the very different nature of the amateur and broadcast services. The Amateur service was designed for those persons interested in radio techniques solely with a personal aim, and without business or pecuniary interests. It is a two-way communications service for information exchange between amateur radio stations. The Broadcast service, on the other hand, is a one-way communications service designed to provide the public with news and entertainment. We see no reason to blur the distinction between these two very different services."

Given the above, amateurs are cautioned about rebroadcasting NOAA's weather broadcasts and transmissions made as part of the space program.

## FCC Chief Scientist Stephen J. Lukasik Resigns

Dr. Stephen J. Lukasik, FCC Chief Scientist since May 1979, resigned in September 1982 to join the Northrop Corporation. There he will be Vice President of the corporation and Manager of the Northrop Research and Technology Center, Palos Verdes, CA.

Before coming to the Commission, Dr. Lukasik was Chief Scientist with the Rand Corporation. His other work has included Director of the Department of Defense Advanced Research Projects Agency (DARPA), a Vice President of the Xerox Corporation, and several positions at Stevens Institute of Technology and the Massachusetts Institute of Technology. He also headed his own consulting firm.

Lukasik is a native of Staten Island, NY. He holds a BS from Rennselaer Polytechnic Institute, and an MS and PhD from MIT. All of his degrees are in physics.

Dr. Lukasik's resignation became effective 2 October.

## FCC to Stop Licensing CB Operators

The signing into law of H.R. 3239 eliminated the Commission's licensing requirements for CB radio operators. In addition, it will no longer be necessary to renew an existing license every five years.

According to *The Washington Post*, the FCC had been processing 55,000 CB licenses a month, although the process required no more than a routine approval and the issuance of a computer-developed license. This number, by the way, is significantly less than the one million applications per month which were processed by the Commission during CB's peak years in the mid-1970s.

Delicensing of CB radio was thought to have few, if any, benefits, and the Commission's efforts in this regard only tied up agency personnel needed for more critical programs.

*Your Washington Editor extends his appreciation to Mr. John Johnston, Chief, Personal Radio Branch (PRB), FCC; to the FCC's Regional Director, San Francisco, CA; and to Mr. Dave Beauvais, KB1F, for their contributions to this month's column.*

*To all my readers, good wishes for a Joyous Holiday Season and a Happy New Year.*


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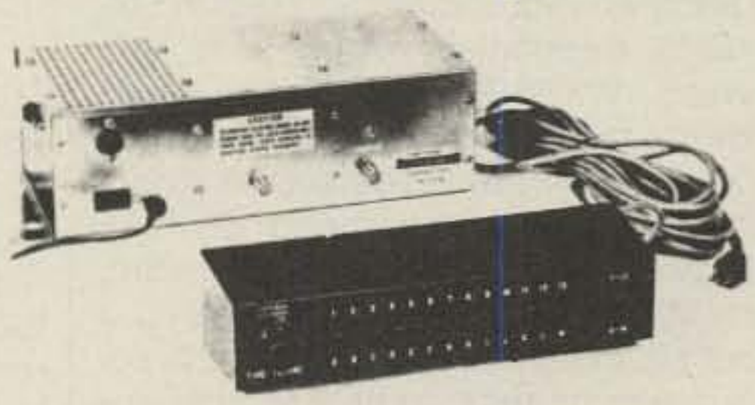

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## NEWS OF COMMUNICATIONS AROUND THE WORLD

It is always sad to report the death of an outstanding DXer and radio amateur. It is particularly sad for us when the silent key is that of a very close friend such as Dick Spenceley, KV4AA, who, as has been reported, passed away July 30, 1982 at his home in St. Thomas, the victim of a massive heart attack. Dick was 77.

Dick Spenceley was one of the real giants of the DX world for two decades, spanning the 1950's and 1960's. His energy, imagination, and singular devotion to DXing led to many innovations and accomplishments which still influence DXers today and will continue to do so for many years to come. As DX Editor of *CQ* magazine from 1951 to 1957, Dick introduced the WPX Award program, which has grown to be one of the most popular awards programs worldwide, competing with the ARRL's DXCC and our own WAZ in numbers of applicants each year. As long as there is DX, there will be prefix chasers and Dick's ideas will live on.

In another area of major interest to DXers, Dick Spenceley, along with Gus Browning, W4BPD, fathered the great worldwide DXpeditions which have thrilled DXers for almost 30 years. Dick's contribution began in the spring of 1955 when an intrepid, young Englishman, Danny Weil, arrived in St. Thomas on a 40-foot sloop named YASME, soon to become the most famous boat in amateur radio history. Weil's goal was to be the first Englishman to sail around the world single-handedly.

Spenceley recognized a common interest between Danny Weil and the world's DXers. He taught Danny the code and helped him arrange a ham license as VP2VB in the nearby British Virgin Islands while outfitting the YASME with ham gear. They then launched the longest DXpedition in history, lasting the 8 years from 1955 to 1963. During these years, Dick served as an officer and QSL Manager for the YASME Foundation, an organization established to sponsor and coordinate Danny's activities, and was editor and publisher of the YASME Foundation Bulletin. The Foundation still survives and has managed QSL's for many DXpeditions by Lloyd and Iris Colvin.

KV4AA was elected to the DX Hall of Fame as its fourth member on March 1, 1969. VP2VB followed shortly after as the fifth member of the Hall of Fame on Sept. 15, 1969.

More recently, Spenceley's goal was to put amateur radio into the *Guiness Book of World Records*. He completed 195,000 QSO's during the period 1976–1981, a feat now under consideration by the Guiness staff.

*The late Dick Spenceley, "King Victor Four Able Able," filling out one of the hundreds of thousands of KV4 confirmations he issued during his long DX career. Dick was a true giant among DXers and was recognized for his accomplishments by election to the DX Hall of Fame in 1969. He passed away on July 30, 1982.*

On a personal note, Dick could be found every day on 20 meters, the same times and frequencies. No matter where in the world our travels took us, that friendly voice could always be heard on 14268 at 11:30 GMT. It's hard to imagine 20 meters without him. All his friends, the world's DXers, will surely miss him. Our sincerest sympathies to XYL, Anna, and the children.

### Those Difficult Zone 2 Stations

For those working toward WAZ, Single Band WAZ, or the 5-Band WAZ awards, Zone 2 is frequently frustrating. This is particularly true for Asian stations whose openings to Zone 2 are rare and of short duration.

Zone 2 is the Northeastern Zone of North America. It is described in the WAZ rules as follows: "VO2-Labrador, that portion of VE2-Quebec north of the 50th parallel, and a portion of the Northwest Territories-VE8 east of longitude 102°." The latter includes part of the District of Franklin and the islands of King William, Prince of Wales, Somerset, Bathurst, Devon, Ellesmere, Baffin, and the Melville and Boothia Peninsulas.

If the zone chaser is lucky enough to confirm a VO2 station, his or her troubles are over, as this means that Zone 2 is clearly confirmed. However, VO2 stations are not plentiful, and many DXers struggle to find a VE2 card from north of the 50th parallel or a VE8 card from east of longitude 102°. That is where the problem arises, as few amateurs put their latitude and longitude on their QSL cards, so how can a DXer be sure that his VE2 is in rare Zone 2, rather than common Zone 5, or that his VE8 is in rare Zone 2, rather than the much easier Zone 1?

As an operating aid for those facing this difficulty, Leo Haijsman, W4KA, our WAZ Award Manager, has compiled a list of stations known to be acceptable for Zone 2 contacts. VE2 calls which Leo has verified to be north of the 50th parallel and in Zone 2 include VE2ACP, VE2AG, VE2AOF, VE2AQS, VE2AS, VE2CSI/2, VE2DS, VE2DUN, VE2DWV, VE2DYL, VE2DYW, VE2DYX, VE2EDK, VE2EDL, VE2EDX, VE2ELL, VE2ENB, VE2END, VE2ENK, VE2ENP, VE2ENR, VE2KK, VE2MTA, VE2MTB, VE2NL, VE2NN, VE2UER/2, VE2WT, VE2XY, VE2YM, KH8AC/VE2, NP2AI/VE2, and W1FM/VE2.

VE8 calls which Leo has verified to be east of longitude 102° and in Zone 2 include DK4TA/VE8, VE4AFG/VE8, VE4AFQ/VE8, VE5AE/VE8, VE8BA, VE8BR, VE8CF, VE8CK, VE8CO, VE8DC, VE8DL, VE8DLC, VE8DW, VE8DX, VE8DYL, VE8HB, VE8MA, VE8MB, VE8MD, VE8ML, VE8MI, VE8MTA, VE8MTB, VE8MTC, VE8MTD, VE8MTE, VE8NH, VE8NI, VE8NO, VE8NS, VE8OX, VE8PB, VE8PC, VE8PF, VE8RB, VE8RCS, VE8RN, VE8TM, VE8TO, VE8YE, VE8YG, VE8YH, VE8YL, VE8YM, VE8YQ, VE8YT, VE8ZZ, K1GAA/VE8, W1LXE/VE8, W1QOX/VE8, W3DNY/VE8, W3VMB/VE8, W4ZDE/VE8, W8RGJ/VE8, and WB0ICS/VE8.

Leo advises that when a VE2 or VE8 card does not show the zone, latitude, or longitude, a photocopy of the card may be forwarded to him for determination. His address is: Leo Haijsman, W4KA, WAZ Award Manager, 1044 Southeast 43rd. St., Cape Coral, FL 33904.

### From the Foundations

*The Northern California DX Foundation (NCDXF)* has been honored by the Iberia DX Club of Madrid, Spain, with the PLACA IDXC Award in recognition of continuous contributions to DX. Previous recipients of this award include Geoff Watts for over 20 years as editor and publisher of the *DX News Sheet*, EA9EO for his outstanding c.w. operations from 3C1AA and 3C0AB, the Mexico DX Club for its DXpeditions to Revilla Gigedo (XF4), and master DXer ZL1AMO for his well-conducted DXpeditions in the Pacific area.

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### Endorsements

Mixed: 450 G4AAQ, HB8BYZ, NA4D, 500 HB8BYZ, NA4D, NE4F. 550 NA4D, NE4F. 600 K5GOE, KC8JH, NE4F. 650 K5GOE, KC8JH. 700 K5GOE, N8BJQ, KC8JH. 750 JA2KVD. 800 JA2KVD. 900 K4ZYU, K9UQH. 950 K4ZYU. 1000 K4ZYU, JA1WPX.

S.S.B.: 350 TI2AJF, WB9AJF/6Y5, WØGOR, VE7DP. 400 TI1AJF, WB9AJF/6Y5, K5GOE, VE7DP. 450 TI2AJF, WB9AJF/6Y5, K5GOE, VE7DP. 500 TI2AJF, K5GOE, IØSGF, VE7DP. 550 K5GOE, IØSGF, K9UAA, VE7DP. 600 K5GOE, IØSGF, K9UAA, VE7DP. 900 VE1YX. 950 N4CRD, VE1YX. 1650 ZL3NS. 1850 K2POA.

C.W.: 350 KA1CLV, JG1HND, DL6YH, OZ5EDR, SM3AZV, VE7DP, NE4F. 400 JG1HND, DL6YH, OZ5EDR, SM3AZV, WA7VJP, VE7DP, NE4F. 450 K8KPM, JH1HND, VE7DP, NE4F. 500 JH1HND, VE7DP, NE4F. 550 JH1HND, VE7DP, NE4F. 600 JH1HND, VE7DP. 650 JG1HND, VE7DP. 700 JG1HND, VE7DP. 750 JG1HND, VE7DP. 800 JG1HND, VE7DP. 1000 I3HDH. 1050 I3HDH. 1100 VE7CNE. 1450 G2GM. 1850 W2NC.

VPX: 1150 UB5-0683. 650 DL-005/1616978. 600 DL-005/1616978.

10 meters: KC8JH.
15 meters: PY1WDS, I3HDH.

Africa: W4ZYQ, VE7DP.
Europe: F6DRP, HB9BYZ, K5GOE, AE1X.
No. America: AG5C, N5BJQ.
So. America: VE7DP.

**Award of Excellence:** VE7DP

Complete rules and application forms may be obtained by sending a business-size, self-addressed, stamped envelope (foreign stations send extra postage if air-mail desired) to CQ WPX Awards, P.O. Box 1351, Torrance, CA 90505-0351 U.S.A.

In other news from NCDXF, Dave Bell, W6AQ, has been unanimously elected to the Foundation's Board of Directors. Dave is prominent in southern California business circles as well as an outstanding DXer. He will be an asset to several of the Foundation's standing committees.

*The International DX Foundation (IDXF)* was sponsor for the St. Pierre and Miquelon (FPØJA) operation by John Ackley, KP2A, in September 1982. Ackley is President and a founding member of the IDXF. QSL's for the FPØJA expedition are being handled by Henry O. Feltman, Jr., WB2MSH, of 20 Progress Ave., Woodbury, NJ 08096.

The next event by KP2A will be a DXpedition to Nepal. He will be accompanied by WB4NFA and WA6YOU and will be on the air from Dec. 20, 1982 to Jan. 1, 1983. They will precede their suffixes with 9N1 except for Dec. 28, 29, and 30. On those days they will use the callsign 9N38 in celebration of the birthday of the King of Nepal. QSL's for this operation should be sent to W1GAY.

The IDXF and NCDXF were co-sponsors with LABRE of the PYØDX expedition to St. Peter and Paul Rocks on Sept. 20–26, 1982. The operators included K8CW, N4BQW, WA2MOE, PY2BZD, and other Brazilian operators. QSL's go to Terry Baxter, N6CW, 4639 Katherine Place, La Mesa, CA 92041.

IDXF member KA3BUJ/8R1 finished his summer stint from Guyana in late August. QSL's go via N7YL. QSL's for the KP2A/KP1 operation from Navassa are caught up. The group working with Henry, WB2MSH, turned them out at a rate of 200–500 per day. The QSO total for that operation was 33,552.

The IDXF is in need of volunteers in several categories. If you are a Foundation member and can help with copying, QSL printing, legal services, accounting, travel services, typing, audiovisual services, or computer services, please get in touch with Bob Schenck, N2OO. The Foundation is also in need of copying machines, typewriters, photographic equipment, portable generators, test equipment, training aids, callbooks (old and new), and all kinds of amateur radio gear. All donated items are said to be tax deductible for U.S. taxpayers.


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- **High or Low RTTY tones**
- **Send and receive CW at 3 to 40 wpm**
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- **Four page video screen display**
- **Six programmable HERE IS messages**
- **Pretype up to 15 lines of text**
- **External keyboard included**
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- **Small size (12.75″ × 5″ × 11.5″)**

Write or call for more details. See the CWR-6850 at your favorite HAL dealer.

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CIRCLE 66 ON READER SERVICE CARD

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- Stainless steel electrical hardware.
- Phone and CW capability all bands!

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**MIVD/2 frequencies $75.95 Post Paid (U.S.)**

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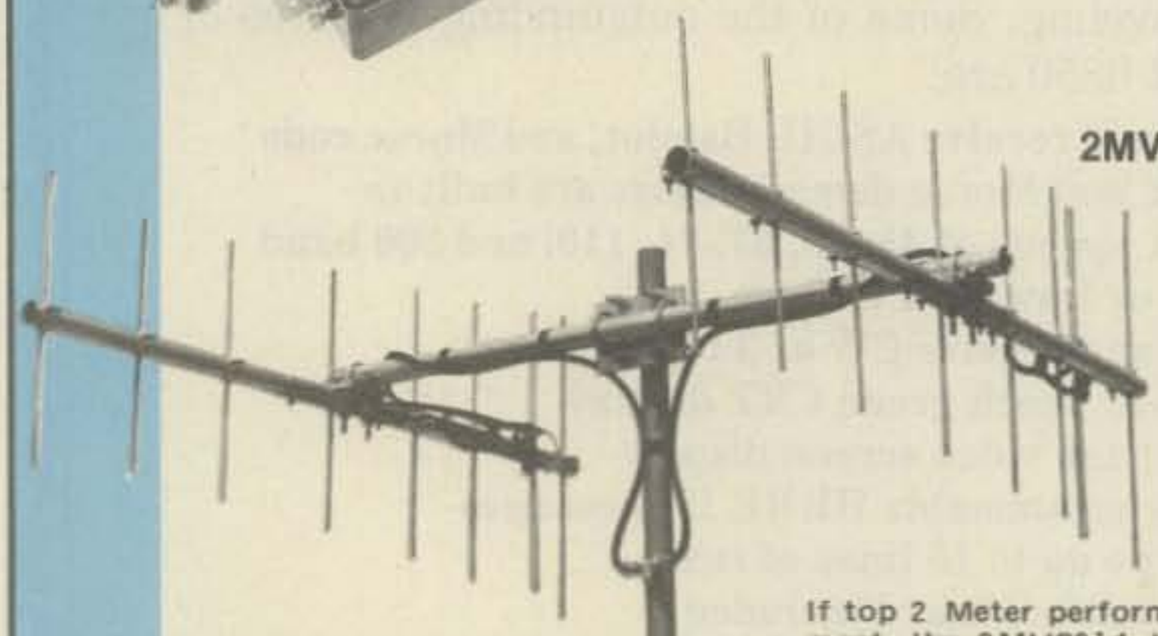

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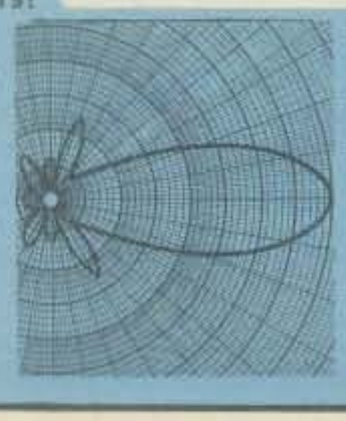
TLI



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Available through your local dealer or direct from the publisher. California orders, please add 6½% sales tax if ordering direct.

*From the Publishers of* The Final Exam

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**415-352-5420**

CIRCLE 132 ON READER SERVICE CARD

## *NEW* TS830S for $150?

Yes indeed! Just add a Matched Pair of top-quality 2.1KHz BW (bandwidth) Fox Tango Filters. Here are a few quotes from users:

*"... Makes a new rig out of my old TS830S! ..."*
*"...VBT now works the way I dreamed it should..."*
*"...Spectacular improvement in SSB selectivity..."*
*"...Completely eliminates my need for a CW filter..."*
*"...Simple installation - excellent instructions..."*

The Fox Tango filters are notably superior to both original 2.7KHz BW units but especially the modest ceramic 2nd IF; our substitutes are 8-pole discrete-crystal construction. The comparative FT vs Kenwood results? VBT OFF — RX BW: 2.0 vs 2.4; Shape Factor: 1.19 vs 1.34; 80dB BW: 2.48 vs 3.41; Ultimate Rejection: 110dB vs 80. VBT SET FOR CW at 300Hz BW — SF 2.9 vs 3.33; Insertion Loss: 1dB vs 10dB.

**OPTIONAL CONNECTIONS**

Fox Tango filters for RX and TX; Fox Tango for RX - Kenwood for TX; FT for RX – switch-select FT or K for TX; switch-select FT or K for RX/TX.

**INTRODUCTORY PRICE: (Complete Kit)...$150**
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CIRCLE 27 ON READER SERVICE CARD

*Kazua Sato, JA1MDK, recently qualified for Single Band WAZ on 10 meter c.w. and is preparing to apply on 10 meter phone. This photo was taken on the roof outside his office at Narita Airport, the international field for Tokyo. Kazua operates 70% c.w. and 30% s.s.b. He is Assistant Manager of the Aircraft Overhaul Engineering Division of Japan Air Lines.*

## News from the DX Clubs

*The Redwood Empire DX Association (REDXA)* includes DX and Contest enthusiasts in the area north of San Francisco, especially Sonoma, Marin, and Napa counties. They meet monthly at local restaurants. For further information, drop a note to Box 4881, Santa Rosa, CA 95402. REDXA officers for 1982–83 are Paul Hansen, AE6H, President; Lyle Meek, N6BLN, Vice President; Chod Harris, WB2CHO/VP2ML, Secretary-Treasurer; and Len Geraldi, K6ANP, and Dick Wilson, K6LRN, Board Members.

*The Kansas DX Association (KDXA)* is offering an award to amateurs outside the lower 48 who work 20 Kansas stations, including 5 KDXA members. The association now has 80 members and will send a complete membership list upon receipt of s.a.e. and one IRC to P.O. Box 454, Salina, KS 67401.

*The Northern California DX Club (NCDXC)* announced the following officers for 1982–83: Eric Edberg, W6DU, President; Ron Panton, W6VG, Vice President; Josephine Clark, WB6ZUC, Secretary; and Chuck Patterson, K6RK, Treasurer. Directors are Merle Parten, K6DC; Dave Leeson, W6QHS; and Bill Zachman, W6TPH. Bob Vallio, W6RGG, is Trustee for W6TI, the NCDXC Memorial Station which broadcasts DX bulletins each Sunday at 1800 GMT or Monday at 0200 GMT on 14.002 MHz. Rod, AC6V, has resigned as Editor of *The DXer* after 18 great issues. Good luck Rod!

*The Delta DX Association* of Louisiana is now managing QSL's for the following DX stations: AH4AA, FG7TD (Dec. 22, 1969 to May 5, 1972 and June 5, 1978 to Sept. 6, 1979), KM6BI (July 8, 1978 to March 30, 1980), KM6FC (Midway only), OY8KH, S2BTF, TL8CN, TL8JM, TL8WH, TR8AC, TR8GDC, VP2A (March 1975), VP2LGR, VQ9JJ, VU2DUE, WD4CEM/KH4, WH4AAA, and WH4AAA/KH7. For confirmation, send s.a.s.e. to Delta DX Association, P.O. Box 73, Metairie, LA 70004.

*Western Washington DX Club* "Totem Awards" numbered 392–397 were issued to ZL2AWW, JE1REU, OK2SGW, OK2BSA, UA2MR, and JA8IXM, respectively, last summer. No. 400 has surely been bagged by now. U.S. applicants must submit proof of contact with 100 different Washington stations, including 20 members of the Club. DX applicants must confirm 25 Washington stations including 10 Western Washington DX Club members. The Club's mailing address is P.O. Box 224, Mercer Island, WA 98040.

*The Southern California DX Club* will hold its annual Christmas Party at the Proud Bird Restaurant. Wayne Gingrich, W6EUF, will entertain with a presentation on his Scandinavian travels, especially his DXpedition to Aland Island. The regular January meeting will be on the 13th 7:30 p.m., at the DWP cafeteria.

At its August meeting, the club membership voted that all charter members of the Southern California DX Club be made honorary life members. These include W6AM, W6AOA, W6BA/W6ANN, K6TX, W6SYG, W6QJU, W6NNV, W6DUC, K6ND/W6GFE, W6EE, W6FSJ, W6BPD, W6TZD, KN6N/W6CYI, W6RW, W6SAI, W6ID, W6DLY, W6EA, W6UHA, W6ENV, W7LEE/W6LEE, W6HX, W6RR, W7AO/W6ADP, W6OB/W6RLN, K6OJ/W6PUY, W6SRF, W6BXL, W6UCX, and W6PQT.

## The WAZ Program

### 10 Meter Phone

| | | | |
|---|---|---|---|
| 214 | W8UVZ | 215 | WD9AHJ |

### 15 Meter Phone

| | | | |
|---|---|---|---|
| 142 | JF1CPH | 144 | WD5HQW |
| 143 | YBØWR | 145 | JA7HMZ |

### 20 Meter Phone

| | | | |
|---|---|---|---|
| 419 | JG1XEZ | | |

### 40 Meter C.W.

| | | | |
|---|---|---|---|
| 37 | SM5AKT | 38 | JA3EMU |

### All Band WAZ

### S.S.B.

| | | | |
|---|---|---|---|
| 2503 | I4TGW | 2510 | K8NWD |
| 2504 | K5BZU | 2511 | OZ3FC |
| 2505 | ON4KL | 2512 | VK2DEJ |
| 2506 | SM6AVM | 2513 | DL8JO |
| 2507 | WD8IIA | 2514 | DF5DP |
| 2508 | VK3AHG | 2515 | NZ4Y |
| 2509 | KØPCG | | |

### C.W. and Phone

| | | | |
|---|---|---|---|
| 5425 | SM5LI | 5428 | K2ON |
| 5426 | W4ZYQ | 5429 | JH1BZJ |
| 5427 | W3UM | 5430 | DL5LAG |

Applications and reprints of the latest rules may be obtained by sending a self addressed stamped envelope (37 cents) size 4½ × 9½ to the W A Z Manager, Leo Haijsman, W4KA, 1044 S.E. 43 Street, Cape Coral, Florida 33904. Applicants forwarding QSL cards either direct to the W A Z manager or to a check point should include sufficient postage for safe return of their QSL cards. The processing fee for all C.Q. awards is $4.00 for subscribers and $10 for non-subscribers. In order to qualify for the subscriber rate, please enclose your latest *CQ* mailing label with your application.

## CQ DX Awards Program

### S.S.B.

| | | | |
|---|---|---|---|
| 1164 | NL7H | 1172 | N6CCL |
| 1165 | NV4O | 1173 | VE2ANE |
| 1166 | VE7BSM | 1174 | KK9Z |
| 1167 | YS1GMV | 1175 | VE6SL |
| 1168 | W8PCA | 1176 | WB4PAB |
| 1169 | WDØDMN | 1177 | TI2AJF |
| 1170 | VE4SK | 1178 | WB9AJF/6Y5 |
| 1171 | KC4MJ | 1179 | VE1YX |

### C.W.

| | | | |
|---|---|---|---|
| 551 | K2PK | 554 | AA6AA |
| 552 | VE3KUC | 555 | K9YAX |
| 553 | OK1DCU | | |

### S.S.B. Endorsements

| | | | |
|---|---|---|---|
| 310 | W4UG/317 | 275 | K8VFV/287 |
| 310 | W3AZD/316 | 275 | W4BIM/275 |
| 310 | N4WF/315 | 250 | VE1YX/274 |
| 310 | K8LJG/312 | 250 | VE7BSM/255 |
| 310 | VE4SK/310 | 200 | TI2AJF/223 |
| 310 | K8PYD/310 | 200 | W4PNY/207 |
| 300 | N4PN/308 | 200 | VE2ANE/205 |
| 300 | 4Z4DX/308 | 150 | N6CCL/169 |
| 300 | K9BWQ/306 | 150 | WB9AJF/6Y5/169 |
| 300 | AA6AA/305 | 150 | VE6SL/150 |
| 300 | W8PCA/302 | QRPp | KK9Z |
| 300 | W7OM/302 | 3.5/7MHz | KL7AF |
| 275 | XE1NI/297 | 3.5/7MHz | TI2AJF |
| 275 | WB4UBD/289 | | |

### C.W. Endorsements

| | | | |
|---|---|---|---|
| 275 | AA6AA/298 | 150 | VE3KUC/169 |
| 275 | K8PYD/284 | 3.5/7MHz | K2PK |
| 250 | K4CXY/252 | 3.5/7MHz | OK1DCU |
| 200 | W6MUL/203 | 3.5/7MHz | K4CXY |

The number of active countries is now 318. The basic award fee for subscribers to CQ is $4. For non-subscribers, it is $10. In order to qualify for the reduced subscriber rate, please enclose your latest CQ mailing label with your application. Endorsement stickers are $1.00. Updates not involving the issuance of a sticker are made free when an s.a.s.e. is enclosed for confirmation of total. Rules and application forms for the CQ DX Awards Program may be obtained by sending a business size, No. 10 envelope, self-addressed and stamped, to CQ DX Awards Manager, Billy Williams, N4UF, Box 9673, Jacksonville, FL 32208 U.S.A. DX stations must include extra postage for air-mail reply.

Addresses for all the above were known at press time with the exception of Russ Davis, Charles Bailey, John Linden, and Mac McKnight.

*The annual Arkansas DX Meeting* and banquet of the Arkansas DX Assn. will be at the Ramada Inn in Fort Smith on Saturday, December 4th. One of the major DX meetings in the border states, this annual event draws a large number of DXers from the Midwest and South. Action starts at 9:00 a.m. on Saturday and runs through the evening, maybe even into Sunday. Write to Harold Wilson, KB5RF, for more details of the event or attendance arrangements.

## Ten Meter Beacons

As Sunspot Cycle 21 declines from its peak in December 1979 toward its predicted low in 1988, openings on 10 meters will be fewer and shorter until the band finally closes altogether near the sunspot minimum. DXers chasing 5 Band WAZ, 5 Band DXCC, or Single Band WAZ on 10 meters will have to watch the band closely and be fast with mike or key to make the needed contacts. Many years ago the band was frequently open, but everyone was listening, no one transmitting, so no contacts were made.

Fortunately, a number of 10 meter beacon stations are now on the air. Each of

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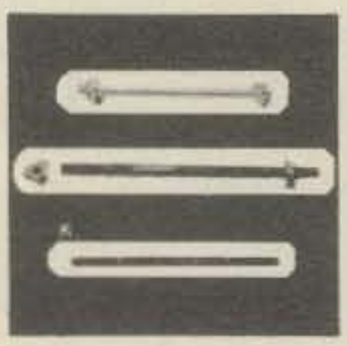
BEVEL
(2:1 TO 5:1)
GEARS



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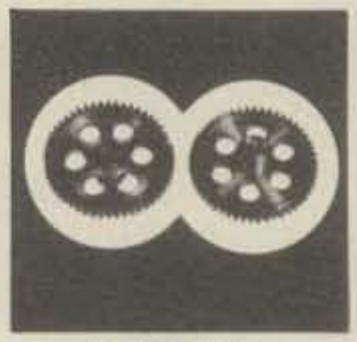

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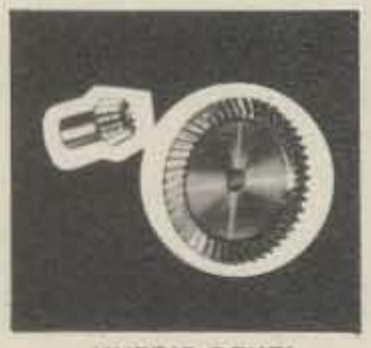

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| MGF1412 NF 0.8DB @ 4GHZ MAG 18DB | $85.00 |
| MCF1200 NF 1.0DB @ 1GHZ, NF 2.2DB & MAG 14DB @ 4GHZ | $14.00 |
| **COAX CONNECTORS** | |
| BNC CHASSIS MOUNT SQUARE FLANGE | $1.95 |
| BNC PLUG FOR RG-58 | $1.95 |
| SMA CHASSIS MOUNT SQUARE FLANGE | $6.10 |
| SMA CHASSIS MOUNT PLUG SQ. FLANGE | $8.50 |
| SMA CHASSIS MOUNT STRIP-LINE TAB | $6.75 |
| SMA PLUG FOR RG-58 | $6.75 |
| SMA PLUG FOR RG-174 | $6.75 |
| SMA PLUG FOR .141 SEMI RIGID | $3.98 |
| TYPE N CHASSIS MOUNT SQUARE FLANGE | $3.75 |
| TYPE N PLUG FOR RG-9/RG-8 | $3.75 |
| TYPE N DOUBLE MALE | $7.25 |
| TYPE N FOR .141 SEMI-RIGID | $15.00 |
| TYPE N CHASSIS MOUNT PLUG SQUARE FLANGE | $14.00 |
| **SILVER PLATING KIT** | |
| Will plate Copper, Brass, Bronze, Nickel, Tin, Pewter, Gold, and most white metal alloys | $36.00 |
| **VTO** | |
| V72T-1 2.7GHZ TO 3.2GHZ MIN POWER OUT 10 MW | |
| TUNING VOLTAGE 0 TO 20V Vcc +15 VDC @ 60 MA | $98.00 |
| V82T-1 SAME AS V72T-1 BUT FREQ 3.6GHZ TO 4.2GHZ | $98.00 |
| **TEFLON CIRCUIT BOARD DBL SIDED 1 OZ** | |
| APPROX. 3.25"× 5.0"× .010 | $5.50 |
| APPROX. 3.25"× 5.0"× .0312 | $6.50 |
| APPROX. 3.25"× 5.0"× .0625 | $10.50 |
| **FEED-THRU CAPACITORS** | |
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CIRCLE 76 ON READER SERVICE CARD

*Reynaldo, HC2RG, recently earned CQ DX Award certificate #1147. He is now working toward WAZ. QSL's for Reynaldo go to P.O. Box 7413, Guayaquil, Ecuador. (Photo via N4UF)*

these stations transmits regularly on a set frequency, enabling the astute DXer to know instantly if the band is open to the part of the world in which the beacon is located. The following list of 10 meter beacons by continent, callsign, and frequency was compiled by W6RQ for *The DXer*.

*Asian Beacon Stations:* 5B4CY 28,220.0; A9XC 28,242.5; VU2BCN 28,285.0, and VS6HK 28,290.0.

*African Beacon Stations:* ZS5VHF 28,202.5; 3B8MS 28,210.0; ZS6PW 28,270.0; ZS1STB 28,302.5; and ZS6DN 28,315.0.

*European Beacon Stations:* DLØIGI 28,205.0; GB3SX 28,215.0; LA5TEN 28,237.5; EA2HB 28,247.5; DKØTE 28,257.5; DFØAAB 28,277.5; and DFØTHD 28,325.0.

*North American Beacon Stations:* WD4HES 28,207.5; VE8AA 28,225.0; VP9BA 28,235.0; VE3TEN 28,252.5; W6IRT 28,888.0; and WD9GOE 28,894.0.

*Oceania Beacon Stations:* ZL2MHF 28,230.0; VK5WI 28,260.0; and VK2WI 28,262.5.

*South American Beacon Stations:* OA4CK 28,240.0; YV5AYV 28,280.0; and VP8ADE 28,285.0.

## Here and There

*Auckland and Campbell Islands:* ZL4OY/A frequents 21,292 kHz from 0230 GMT on weekends and may visit the Open House Net on 14,333 at 1100–1200 GMT. In addition, he can be found with ZL4PO/C near 7080 from 0600 to 0900.

*Brunei:* Look for VS5GA on 21280–290 from 0630 GMT and VS5HG on 14205–215 around 1300 GMT. VS5TT likes 7001–03 kHz most days from 1300 GMT.

*Central African Republic:* TL8GE is near 21,287 at 2100 GMT.

*Chagos:* VQ9CI has a strong signal on 14,210 from 1100 hours and on 21,300 from 1630 hours.

*Contest Logs:* Tired of duping your contest logs? The N6TR Computer Duping Service will do it for you. For rates and info, call (805) 526-3372, or write to 1850 Stow St., Simi Valley, CA 93063.

*Dodecanese Islands:* SVØCJ/5 on Rhodes is near 3600 kHz from 0001 GMT and near 14255 from 2200 GMT.

*Eric:* SMØAGD recently received an ICOM transceiver, generator, and other equipment from the Northern California DX Foundation. He should be hopping the central Pacific islands and nearing Honolulu.

*Iraq:* JA1DNG/YI has been active 21,250–265 from 1530–1800 GMT.

*Malagasy Republic:* 5R8AL is regularly near 21,320 from 1630 GMT. He moves to 14290 at around 2000 GMT.

*Mauritius Island:* 3B8CF is on regularly at 0230 GMT near 7005 kHz.

*Moldavia:* UK5OAA likes 14220–240 daily from 1800Z.

## 5 Band WAZ

### Standings as of September 1, 1982

**All 200 zones worked:**

1. ON4UN, John Devoldere (Belgium)
2. K4MQG, Gary Dixon (U.S.A.)
3. SM4CAN, Kent Svensson (Sweden)
4. AA6AA, Steve Orland (U.S.A.)
5. W8AH, Albert Hix (U.S.A.)
6. W6KUT, E. A. Andress (U.S.A.)
7. EA8AK, Fernando Fernande (Spain)
8. LA7JO, Stig Lindblom (Norway)
9. EA3SF, Fernando Blenert (Spain)
10. OH1XX, Hannu Nieminen (Finland)
11. EA8OZ, Julio Rosello (Spain)
12. WØSD, Edward Gray (U.S.A.)
13. KØZZ, Gary Knutson (U.S.A.)
14. ON6OS, P. Michiels (Belgium)
15. OK3TCA, E. Melcer (Czech.)
16. K6SSS, Fred Capossela (U.S.A.)
17. ZL3GQ, Peter W. Watson (New Zealand)
18. OK3CGP, Stefan Melcer (Czech.)
19. SMØAJU, Leif Lundin (Sweden)
20. OZ3PZ, Preben Thomsen (Denmark)
21. I3MAU, Reno Mauri (Italy)
22. I2ZGC, Gianni Zillio (Italy)
23. 4Z4DX, Dov Gavish (Israel)
24. N4KE, Ron Blake (U.S.A.)
25. K5UR, Rick Roderick (U.S.A.)
26. K9AJ, Michael McGirr (U.S.A.)
27. SM3EVR, Tord E. Julander (Sweden)
28. LA5YJ, Bjorn Hugo Ark (Norway)
29. DL3RK, Walter Geyrhalter (W. Germany)
30. N4WJ, Frank McCormick (U.S.A.)
31. G3MCS, W.R. Hawthorne (England)
32. SM5AQD, Hakan "Hawk" Eriksson (Sweden)
33. WØMLY, George McKercher (U.S.A.)
34. IØRIZ, Gianni Rizzi (Italy)
35. ON5NT, Ghislain Penny (Belgium)
36. OH6JW, Antti Kiviuoma (Finland)
37. OK1AWZ, Milan Dlabac (Czech.)
38. IV3PRK, Pierluigi "Luis" Mansutti (Italy)
39. DJ6RX, Klaus Heintzenberg (W. Germany)
40. OH3YI, Ossi Lehvas (Finland)
41. I4RYC, Relli Claudio (Italy)
42. ZL1BIL, Mike Edwards (New Zealand)

**The top contenders for 5 Band WAZ:**

1. JA3EMU, 199
2. F5VU, 199
3. CT1FL, 198
4. N4RR, 198
5. DL3RX, 198
6. TG9NX, 198
7. W8UVZ, 198
8. EA8QL, 197
9. K1MEN, 197
10. K7UR, 196

**172 Stations have attained the 150 zone level**


**WIRE & CABLE**

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| RG-213 mil. spec. | 27¢/ft |
| RG-214 mil. spec. | 1.25/ft |
| RG-8U foam, 95% braid | 23.5¢/ft |
| RG-8X foam, 95% braid | 11.5¢/ft |
| RG-58U mil. spec. | 10.5¢/ft |
| RG-174 micro. mil. spec. | 8.5¢/ft |
| RG-11U foam 95% braid | 19¢/ft |
| RG-11A/U mil. spec. | 24¢/ft |
| RG-59U foam | 11.5¢/ft |
| RG-59U mil. spec. | 11.5¢/ft |
| 300 ohm ladder line poly ins. | 6¢/ft |
| 450 ohm ladder line poly ins. | 8¢/ft |
| 450 ohm ladder line bare, 100 ft | $11.00 |
| 8 conductor rotor cable | 15¢/ft |
| 4 conductor rotor cable, 100 ft | $5.50 |
| 14 Ga. Stranded Copperweld, 70ft roll | $4.95 |
| 14 Ga. Stranded Copperweld, 140 ft roll | $9.00 |
| 12 Ga. Solid Copperweld 50ft multiples | 8¢/ft |
| 14 Ga. Solid Copperweld 50ft multiples | 6¢/ft |
| 18 Ga. Solid Copperweld 50ft multiples | 4¢/ft |
| 14 Ga. Stranded Copper | 8¢/ft |
| 8 Ga. Solid Aluminum 50ft multiples | 8¢/ft |

**ANTENNA ACCESSORIES**

| | |
|---|---|
| Amphenol silver plate PL-259 | 75¢/ea |
| Ceramic dogbone insulators | 65¢/ea |
| Ceramic strain insulators | 40¢/ea |
| Coaxial lightning arresters | $3.75 |
| Coax seal, roll | $1.95 |
| W2AU balun 1:1 or 4:1 | $14.25 |
| W2AU END-sulator | $1.35 |
| W2AU traps 10,15,20 or 40 mtr | $18.95/pr |
| W2AU traps 75 or 80 mtr | $50.40/pr |
| VAN GORDEN Hi-Q 1:1 balun | $8.95 |
| VAN GORDEN Center insulator | $5.75 |
| B&W Traps 40/80-10 mtrs | $26.75/pr |
| B&W 375 or 376 coax switch | $19.25 |
| B&W 593 coax switch | $17.95 |
| B&W 595 coax switch | $22.50 |
| B&W 5KW balun 1:1 or 12:1 | $36.00 |
| B&W 5KW balun 4:1 or 6:1 | $45.00 |

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| HY-GAIN AR-22XL | $58.95 |
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| HY-GAIN Tailtwister | $241.50 |
| HY-GAIN HDR-300 | $422.00 |
| BUTTERNUT HF6V | $108.29 |
| BUTTERNUT TBR-160HD | $47.50 |
| BUTTERNUT RMK-II | $37.90 |
| BUTTERNUT 2MCV 2 mtr colinear | $34.00 |
| BUTTERNUT 2MCV-5 NEW 2 mtr colinear | $41.00 |
| MINI-PRODUCTS HQ-1 Mini Quad | $127.95 |
| MINI-PRODUCTS MiniBeam | $99.50 |
| MINI-PRODUCTS C-4 Vertical | $55.00 |
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| 10 ft heavy duty tripod tower | $34.95 |
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**STATION ACCESSORIES**

| | |
|---|---|
| Bencher Paddles, black/chrome | $35.00/42.75 |
| Drake TV-3300LP lkw low pass filter | $26.50 |
| BMI clocks 173B digital, 973A analog | $31.99/37.15 |
| Shure 444D dual imp. mic. | $47.95 |
| DAIWA Meters 520/550 | $59.95/76.00 |
| DAIWA Tuners 418/518 | $165.99/272.95 |
| DAIWA DK-210 keyer w/led speed ind. | $79.20 |
| DAIWA LA2035 30w 2mtr fm,ssb,cw linear | $69.50 |
| NYE VIKING MB11-01/02 ant. tuners | $299.95/279.95 |
| NYE VIKING automatic phone patch | $48.36 |
| NYE VIKING 3kw low pass filter | $22.50 |
| TELEX HEAD SETS | ALL AT BIG DISCOUNT |
| AEA code readers, keyers | ALL AT BIG DISCOUNT |
| VOCOM 5/8 2mtr collapsible ant. | $15.95 |
| VOCOM 200mw in 25w out 2mtr amp. | $82.75 |
| VOCOM 2w in 25w out 2mtr amp. | $69.75 |
| VOCOM 2w in 50w out 2mtr amp. | $103.95 |
| VOCOM POWER POCKET | $175.55 |
| AMECO PREAMPS PLF-2/PT-2 | $45.90/65.99 |
| **KDK-FM2030** 2mtr transceiver | $275.00 |

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## The WPX HONOR ROLL

The WPX Honor Roll is based on the current confirmed prefixes which are submitted by separate application in strict conformance with CQ master prefix list. Scores are based on the current prefix total regardless of an operator's all-time count. Honor Roll must be up-dated annually by addition to, or to confirm present total. If no up-date, file will be placed into "inactive" until next up-date. Lifetime Honor Roll fee $2.00, with no fees required for up-dates.

### MIXED

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2342 | YU2DX | 1619 | N9AF | 1269 | PA2TMS | 923 | WB8YQX | 765 | AI8M |
| 2330 | F9RM | 1600 | N6JV | 1262 | IN3ANE | 921 | YU2CBK | 757 | AJ6O |
| 2113 | K6JG | 1584 | DJ7CX | 1240 | K6ZDL | 901 | I2MQP | 747 | G3ZRH |
| 2061 | K2VV | 1555 | N2AC | 1235 | KF2O | 893 | JA1KRU | 738 | WD9IIC |
| 2057 | W2NC | 1542 | N4NO | 1200 | W8RSW | 879 | N4IB | 727 | K7CU |
| 2025 | K6XP | 1508 | SM7TV | 1198 | JH1VRQ | 865 | WB8ZRL | 722 | W6OUL |
| 2019 | VE3GCO | 1493 | W8CNL | 1185 | K9LJG | 850 | KA3A | 721 | W8ILC |
| 2005 | YU4HA | 1448 | YU7AW | 1170 | SM3EVR | 826 | K2QF | 703 | VE2FOU |
| 1882 | YU7BCD | 1419 | W9FD | 1149 | YU1OBA | 825 | G4FAM | 700 | KC8JH |
| 1853 | N4MM | 1415 | AA4A/8 | 1145 | N6AW | 820 | K7AGJ | 700 | I1ZQD |
| 1798 | W9DWQ | 1370 | I6SF | 1129 | W7CB | 804 | KO8T | 650 | KJ7N |
| 1790 | W4BQY | 1307 | W0SFU | 1124 | DJ2UU | 800 | W6YMH | 638 | K9TI |
| 1718 | W7LLC | 1292 | K9BG | 1056 | N6JM | 793 | DK2BL | 630 | OE1KJW |
| 1707 | PA0SNG | 1283 | WA1JMP | 1002 | KL7AF | 787 | JA9FAI | 627 | K8HF |
| 1675 | K5UR | 1282 | N6FX | 956 | LA7JO | 768 | W0JIE | 607 | WD8IIA |

### S.S.B.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 2244 | F9RM | 1427 | K5UR | 1108 | W4BQY | 922 | CT1UA | 750 | AC2J |
| 2039 | I0ZV | 1410 | I0MBX | 1062 | PY3BXW | 922 | TG4NX | 743 | PY4OD |
| 1832 | K2POA | 1357 | W0YDB | 1060 | DJ7CX | 901 | I2MQP | 739 | VK6YL |
| 1816 | K6JG | 1336 | W9DWQ | 1044 | W2CC | 900 | N2AC | 703 | W3GXK |
| 1797 | K6XP | 1276 | OZ5EV | 1037 | OE2EGL | 883 | KC8CC | 700 | N4IB |
| 1739 | K2VV | 1250 | N2SS | 1014 | N6FX | 851 | I8KCI | 668 | DK4AP |
| 1700 | N6CW | 1201 | AA4A/8 | 1011 | KF2O | 833 | TG9GI | 652 | KB2DE |
| 1667 | ZL3NS | 1201 | WD8MGQ | 1005 | ZP5RS | 828 | I0RIZ | 650 | OE8MOK |
| 1646 | N4MM | 1190 | YU7AW | 991 | W2NC | 820 | WA2FKF | 611 | JH5FQO |
| 1551 | I4ZSQ | 1189 | HP1JC | 990 | KC4OV | 809 | K8LJG | 606 | W8RSW |
| 1551 | I8KDB | 1170 | WA4QMQ | 981 | W6YMV | 809 | W8ILC | 603 | I0SGF |
| 1523 | YU7BCD | 1154 | I6ZJC | 952 | WA4OIB | 805 | KL7AF | 602 | W0ULU |
| 1462 | PA0SNG | 1134 | N4NO | 949 | G4CHP | 750 | WB8ZRL | | |

### C.W.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1835 | W2NC | 1475 | K6XP | 1315 | K5UR | 1068 | LZ1XL | 731 | AA4A/8 |
| 1823 | W8RSW | 1412 | W9DWQ | 1312 | W9FD | 1056 | N6FX | 690 | DJ1YH |
| 1737 | W8KPL | 1376 | N2AC | 1258 | VO1AW | 965 | JE1JKL | 689 | KA3A |
| 1639 | WA2HZR | 1375 | G2GM | 1225 | DJ7CX | 930 | N4YB | 682 | JA5MG |
| 1599 | ON4QX | 1344 | W3ARK | 1136 | YU7AW | 861 | K8LJG | 618 | G4FAM |
| 1580 | K6JG | 1330 | VK4SS | 1127 | W1WLW | 853 | DJ3LR | 616 | W8ILC |
| 1562 | N6JV | 1324 | N4NO | 1122 | I6SF | 827 | I1YRL | 605 | VE2FOU |
| 1558 | K2VV | 1317 | W4BQY | 1102 | VE7CNE | 804 | KF2O | 600 | OE1KJW |
| 1524 | YU7BCD | 1316 | N4MM | 1077 | K6ZDL | 750 | KL7AF | | |

*Oman:* A4XJO is filling a huge c.w. demand with appearances on 7002–005 from 0130 GMT.

*Qatar:* A71AD likes 21,290–310 from 1700–2130 GMT. Mike has hung an inverted Vee for 80 meters and is raising a beam on 40.

*Reunion Island:* FR0FLO maintains a regular sked near 3790 kHz at 0245–0315 GMT. He is usually near 21,262 kHz from 1800 hours.

*Rwanda:* 9X5PP frequents 14,300 kHz from 1800–2000 GMT, while 9X5WP works the high ends of both 15 and 20, 14,340 from 0400–0600 and a bit above 21,400 at 1900 GMT.

*Tristan da Cunha:* ZD9YL is active on 14,225–35 after 1100 GMT and 21,335 from 1800 GMT several days each week.

*Turkey:* TA2BK is extremely active on c.w. and s.s.b. He favors 14,030, 14,275, 21,030, and a 10 kHz spread around 21,300 kHz from 1000–1200 and 1800–2000 GMT.

*Upper Volta:* XT2AW can usually be found within a few kHz of 21,300 after 0230 GMT.

*Western Samoa:* 5W1DQ likes 14,210–220 kHz from 1000–1200 GMT. He has also used the 5W5 prefix to commemorate the anniversary of their independence.

*Willis Island:* From now through mid-December, listen for VK9ZA near 14,205–210. He is also on the Open House Net on 14,332 kHz. Favorite times are from 1100 to 1600 GMT.

## Acknowledgements

The DX department is greatly appreciative of the following special publications from which we draw much of our news: *Long Island DX Bulletin* (W2IYX), *QRZ DX* (K5FUV), *DX News Sheet* (Geoff Watts/RSGB), *DX-Press* (PA0GAM), *DX-NL* (DL3RK), *DXers Magazine* (W4BPD), *The DXer* (NCDXC), the *Southern California DX Club Bulletin* (W6YQ), the *Totem Tabloid* (K7ZR), and the *National Contest Journal* (K7GM).

## QSL Information

**BY1PK** to P.O. Box 6106, Beijing, Peoples Republic of China
**C30DN** to EA3BKZ
**C31XP** to DJ9ID
**D68AM** to WA4VDE
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**FP0HBL** to AE1W
**FR7CG/T** to F1DYD
**HH2VP** to N4XR
**HS1BV** to KO2A
**HZ1AB** to K8PYD
**HZ7JZ** to K4GXY
**ID9ON** to I3ON
**JA1DNG/YI** to JA2TPS
**JW7FD** to LA5NM
**JY9RC** to W1CKA
**J88AQ** to W2MIG
**K4YT/5N0** to W2TK
**KC6SX** to JA8OW
**KC6WS** to AD1S
**LZ0GDP** to LZ2VP
**OJ0MA** to OH0NA
**P42E** to Mike Colesante, 7707 Lee Highway #203, Falls Church, VA 22042
**SM0GMG/OH0** to SM0DJZ
**T30AT** to G3XZF
**T32AH** to KE0A
**TG9EW** to I0WDX
**TL8DC** to F6EWM
**UK8JBD/U6R** to UJ9JCT
**V2AU** to OE3ALW
**V2AZE** to G3EBR
**V3TV** to G3ATK
**VK2BEX** to WD9GDR
**VP2KK** to W3HNK
**VP5WJR** to KA5BPE
**VQ9CI** to KA4UMB
**VQ9SB** to WA6IJZ
**VQ9XX** to N6BFA
**VS5DD** to G4EFE
**VS6GZ** to OE1HGC
**VK9YA** to VK5QX
**YB0PG** to KB5AS
**ZD7HH** to W4FRU
**ZD9BV** to W4FRU
**ZD9YL** to W4FRU
**ZK1XG** to DB9CH
**ZP5JAL** to Box 1311, Asuncion, Paraguay
**3V8AL** to DL5MBY
**4D6GEN** to DU6GEN
**4K1A** to UA0CEY
**4K0A** to UA1ADQ
**5N0KNO** to Box 21055, Lagos, Nigeria
**6Y5FS** to G3XTJ
**6Y5SS** to G3XTJ
**7X2AK** to Algeria Bureau, ARA QSL Service, Box 2, Algiers, Algeria
**9N1MM** to N7EB
**9V1VF** to Bureau, S.A.R.T.S., Box 2728, Singapore 1
**9Y4VU** to W3EVW

*Outgoing QSL Services.* Following the death of W3KT, there has been significant interest in other private outgoing bureaus to serve those who do not use the ARRL outgoing QSL Bureau to send their cards to DX stations. There are two relatively new such services. These are:

N7RO - DX QSL Service
2935 Plymouth Drive
Bellingham, WA 98225

Howard Messing, WA2NHA
16 Erli Street
Wayne, NJ 07470

We suggest that you contact them directly for details.

73, John, K4IIF

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CIRCLE 8 ON READER SERVICE CARD

# Contest Calendar

*a monthly feature by*
**FRANK ANZALONE, W1WY**

## NEWS/VIEWS OF ON-THE-AIR COMPETITION

The following verse composed by Alan Shawsmith, VK4SS, impressed me as being a nostalgic tribute to the memories of our departed friends KV4AA, W2PV, W3KT, and W2EQS.

Age, in the end, must weary them
(Tho not their spirits wane)
When voice or hand cannot come up
To face the rounds again.
But in the frenzy and the strife,
I ask you, cease awhile:
Hark! Do the echoes of their calls
Still linger in the pile?
Take but one short silent pause
To let them once again
Come flooding clearly back to mind
Like some old sweet refrain.

A reminder: the Dick Spenceley, KV4AA, Memorial Plaque for this year's WW DX C.W. Contest will be awarded to the single operator making the most contacts on All Bands. It's the most *contacts*, not the highest score.

I strongly advise all 160 meter contesters to carefully review the new 160 Contest rules in this issue, especially the new scoring format. Also note that we now have a World Champion Plaque in the Phone Contest—a fitting memorial for Mr. 160, Charlie O'Brien, W2EQS. The plaque is donated by W8IMZ and W1WY.

Garry Hammond, VE3GCO, has recently introduced a new publication devoted exclusively to contesting. It covers all the major contests in the world with helpful maps, statistical tables, and other operating aids. For more details, drop Garry a note at 5 McLaren Ave., Listowel, Ont., Canada N4W 3K1.

Annoucement of the VK QRPp C.W. Contest November 20–21 was received much too late to make the November issue. If you got involved, your logs this year go to VK CW QRPp Club, P.O. Box 109, Mt. Druitt, N.S.W. 2770, Australia.

You have until January 15th to submit your log for our WW DX C.W. Contest. This year the C.W. logs go to Larry Brockman, N6AR, 7164 Rock Ridge Terrace, Canoga Park, CA 91307. Of course, they can also be sent to our home office, 76 N. Broadway, Hicksville, NY 11801. Be sure to indicate C.W. on the envelope.

Deadline for material for the March issue is December 15th, and January 15th for the April issue. Again I request that all announcements be sent to my home address.

*14 Sherwood Road, Stamford, CT 06905*

### Calendar of Events

| | | | |
|---|---|---|---|
| | **Nov.** | **27-28** | **CQ WW DX C.W. Contest** |
| | Dec. | 3-5 | ARRL 160 M. C.W. Contest |
| | Dec. | 4-5 | Connecticut QSO Party |
| | Dec. | 4-5 | TOPS 3.5 MHz C.W. Contest |
| † | Dec. | 4-5 | Spanish Phone Contest |
| | Dec. | 4-6 | Telco. Pioneers QSO Party |
| † | Dec. | 11-12 | Spanish C.W. Contest |
| † | Dec. | 11-12 | Hungarian C.W. Contest |
| | Dec. | 11-12 | ARRL 10 Meter Contest |
| | Dec. | 19 | Canada Contest |
| | Jan.1- | Dec.31 | U.B.A. SWL Competition |
| | Jan. | 8&9 | "73" 40 & 80 Meter Phone |
| | Jan. | 8-10 | ZERO District QSO Party |
| | Jan. | 15 | WCY Activity Contest |
| | Jan. | 15 | "Hunting Lions" QSO Party |
| | Jan. | 15-16 | Michigan QRP C.W. Contest |
| | Jan. | 15-16 | "73" 160 Meter Phone |
| | Jan. | 15-16 | AGCW-DL QRP C.W. Contest |
| | **Jan.** | **28-30** | **CQ WW 160 M. C.W. Contest** |
| | Jan. | 29-30 | White Rose SWL Contest |
| | Feb. | 12-13 | QCWA C.W. QSO Party |
| | Feb. | 12-13 | YL-OM Phone Contest |
| | Feb. | 12-13 | Dutch PACC Contest |
| | Feb. | 19-20 | ARRL DX C.W. Contest |
| | Feb. | 19-20 | YL ISSB Phone Party |
| | Feb. | 26 | "73" RTTY Contest |
| | **Feb.** | **25-27** | **CQ WW 160 M. Phone Contest** |
| | Feb. | 26-27 | YL-OM C.W. Contest |
| | Mar. | 5-6 | ARRL DX Phone Contest |
| | Mar. | 12-13 | QCWA Phone QSO Party |
| | Mar. | 12-13 | YL ISSB C.W. QSO Party |
| | **Mar.** | **26-27** | **CQ WW WPX S.S.B. Contest** |

† *Not official.*

Although this is being written in the middle of September, this is the December issue and Holiday Greetings are in order. Do have a Happy Christmas and all the best for the coming year.

73 for now, Frank, W1WY

## ARRL 160 Meter C.W. Contest

Starts: 2200Z Fri., Dec. 3
Ends: 1600Z Sun., Dec. 5

This is the 13th year for this top band activity. Exchanges will be between stateside and VE and DX stations. DX to DX contacts, however, are not permitted.

**Classes:** Single operator and multi-operator.

**Exchange:** RST and your ARRL section; country for DX and ITU region for maritime mobiles.

**Scoring:** Contacts between stations in ARRL sections count 2 points, with DX stations 5 points.

**Multiplier:** Determined by the number of ARRL sections plus VE8/VY1 (maximum of 74) and DX countries worked (for W/VE participants). (DX use ARRL sections only.)

**Final Score:** Total QSO points times the ARRL section and DX multiplier.

**Awards:** Certificates to the top-scoring single operator station in each section and DX country, and to the top-scoring multi-operator station in each ARRL division and continent.

The ARRL 160 band plan requires that W/VE stations transmit only in the 1800–1825 and 1830–1850 kHz segments, keeping the "DX Window" (1825–1830 kHz) clear for DX stations. They will indicate where they will be listening for cross-frequency contacts.

The usual grounds for disqualification—violation of rules, excessive duplicate contacts, etc.—will prevail.

Logs with more than 200 QSO's must include dupe sheets. A large s.a.s.e. to the ARRL will get you the necessary forms to make log keeping easier.

All entries must be postmarked no later than January 4th and go to: ARRL Communications Dept., 160 Contest, 225 Main Street, Newington, CT 06111.

## Connecticut QSO Party

1100Z Sat. to 1100Z Sun., Dec. 4–5

The Candlewood ARC is again sponsoring this year's party. Phone and c.w. are part of the party. Their club station, W1QI, will be on c.w. on odd hours and s.s.b. on even hours.

The same station may be worked on each band and on each mode for QSO points, mobiles in each county change. Oscar contacts are considered a separate mode.

Novices should identify by sending /N as part of their call. Mobiles should identify their county.

**Exchange:** QSO no. and QTH. County for Conn. stations, ARRL section for others.

**Scoring:** One point per QSO, 2 points if it's with a Novice, 3 points for Oscar contacts, and 5 points if it's with W1QI (each band and each mode).

**Multiplier:** ARRL sections and provinces for Conn. Out-of-state stations use Conn. counties (maximum of 8).

**Final Score:** Total QSO points times ARRL sections and VE provinces for Conn., and Conn. counties for others.

DX stations may be worked for QSO points, but count once only for a multiplier.

**Frequencies:** C.W.—40 kHz up from bottom of each band. S.S.B.—3927, 7250, 14295, 21370, 28540. Novice—3725, 7125, 21125, 28125.

**Awards:** Certificates to top scorers in each Conn. county and each ARRL sec-



Say You Saw It In CQ

tion (minimum of 5 QSO's). Also the "Worked All Connecticut Counties" certificate to each station contacting all 8 Conn. counties.

Include a large s.a.s.e. for a copy of the results, and mail your log by January 2nd to: Stephen Grouse, KA1ECL, 3 Queens Court, Danbury, Conn. 06810.

## TOPS 3.5 MHz C.W. Contest

1800Z Sat. to 1800Z Sun., Dec. 4–5

Activity in this one is in the 3.5 to 3.6 portion of the 80 meter band. In the past, participation has been almost totally confined to Europe. This year, however, the lower 12 kHz has been set aside for DX contacts only. Now at least the U.S. Extras will be able to break through the European curtain.

The contest is open to both single and multi-operator stations world wide. Single operators must take one 7-hour break during the contest. Multi-operators can continue the full 24 hours.

**Exchange:** RST plus a QSO number starting with 001. TOPS members will include their membership number.

**Scoring:** QSO's between stations within own country, 1 point. (Each call area in W, VE, VK, PY, and UA is counted as a separate country.) With other countries but same continent, 2 points. With other countries in other continents, 6 points. QSO's with TOPS stations earn 2 bonus points. If between member stations, 3 bonus points.

**Final Score:** Total QSO and bonus points times number of different prefixes worked (prefixes as in *CQ* WPX).

**Awards:** Certificates to winners in each country. Include an addressed envelope and IRC for results. Mailing deadline for logs is January 31, 1983 to: Bertil Arting, SM3VE, Bergesvegen 26, S-823 00 Kilafors, Sweden.

*(In the 1981 list of results there wasn't a single entry from the Americas. My interpretation of the rules indicates that this is a worldwide contest, and contacts between stations in countries in areas other than Europe are valid. Some W and VE activity on 80 should make it interesting—ed.)*

## Telco. Pioneers QSO Party

Starts: 1900Z Sat., Dec. 4
Ends: 0500Z Mon., Dec. 6

This is the 18th annual party organized by the Telephone Pioneers of the U.S. and Canada. This year's party marks the 70th anniversary of Pioneering, and it is again being sponsored by the John D. Burlie Chapter #89 of Columbus, Ohio.

Members may be contacted on each band and each mode if they are in different chapters, but only one contact is permitted between stations in the same chapter.

**Exchange:** QSO no., and chapter name and number (ITPA chapters, name only).

**Scoring:** One point per QSO and one multiplier for each chapter worked. Chapters count once only (maximum of 97 TPA and 5 ITPA chapters).

**Frequencies:** Phone—3965, 7275, 14295, 21365, 28675, 50.1–54.0, 144.1–148. C.W.—3565, 7065, 14065, 21065, 28065. Novice/Tech.—3725, 7125, 21125, 28125. Plus or minus 10 MHz.

**Awards:** Certificates to the highest scoring chapter, top-scoring Pioneer Club station, and individual Pioneers and Pioneer Life Member.

Mailing deadline for all entries is January 15th. Log sheets may be obtained from your Radio Club Coordinator or Administrator. Logs go to: John D. Burlie Chapter #89, Att: Ted Phelps, W8TP, c/o Western Electric Dept. 45430, 6200 East Broad Street, Columbus, OH 43213.

*This group of QCWAers represents over 430 years in amateur radio. Left to right are W1ASD, W4COW, W2CVF, W1WY, W2HL, W2FRX, W2AUF, and W2AHW. This is really not a contest or DX group, but over the years we have handed out our share of QSO's. (Photo was taken last June. W2HL, holder of a 60 year certificate, became a Silent Key on September 3rd.)*

## Canada Contest

0001 to 2359Z Sun., Dec. 19

Again sponsored by the Canadian Amateur Radio Federation, this contest follows the same pattern as the Canada Day Contest last July.

Activity will be on all bands, 2 through 160 meters, phone and c.w. Single operator, single and all band, multi-operator all band only.

The same station may be worked on each band and each mode for QSO and multiplier credit.

**Exchange:** RS(T) and QSO number starting with 001, and province for VE1's.

**Scoring:** 10 points for each contact with Canada, 1 point if with others, and 10 bonus points for each contact with any CARF official news station using the suffix TCA or VCA.

**Multiplier:** Number of VE provinces/territories worked on each band and each mode (12 prov./terr. × 8 bands × 2 modes for a maximum of 192 possible).

Contacts with stations outside of Canada count for QSO points but no multiplier; VE1's are requested to identify their province.

**Frequencies:** Phone—1810, 3770, 3900, 7070, 7230, 14150, 14300, 21200, 21400, 28500, 50100, 146520. C.W.—1810, 3525, 7025, 14025, 21025, 28025, 50100, 144100. Try phone on even hours, c.w. on odd hours.

**Awards:** A Trophy to the overall single operator winner. Certificates to the top scorers in each category, in each VE province/territory, U.S. call area, and DX country, and also to the highest score from a Canadian non-Advanced amateur.

Include a summary sheet showing the scoring and also a dupe sheet with your log. Mailing deadline is February 1st to: Canadian A.R.F., P.O. Box 2172, Stn. D, Ottawa, Ont. K1P 5W4, Canada. Non-members may include an s.a.s.e. for copy of results (do not attach stamps).

## Spanish DX Contest

Phone: Dec. 4–5 C.W.: Dec. 11–12
Starts: 2000 GMT Saturday
Ends: 2000 GMT Sunday

It's the world working the Espanoles with separate weekends for phone and c.w. Only single operator operation is permitted, all bands 3.5 through 28 MHz.

**Exchange:** RS(T) plus a three figure QSO number starting with 001.

**Scoring:** Contacts between EA stations and the following prefixes are worth 3 points: DU, CE, CM/CO, CP, CX, HC, HI, HK, HP, HR, KP4, LU, OA, PY, TG, TI, XE, YN, YS, YV, ZP, or equivalent prefixes.

Between EA and all other non-Hispano and non-European countries, 2 points.

Between EA and Europeans, 1 point (WAE boundaries).

**Multiplier:** For EA, each DXCC country worked on each band. All others use EA call districts worked on each band.

**Final Score:** Total QSO points from all bands times the multiplier from each band.

**Awards:** Gold, Silver, and Bronze medals to the first 3 places, phone and c.w., in Spain and to overseas winners. Certificates to first place winners in each country. A minimum of 100 points required to qualify.

Include a summary sheet with your log showing the scoring and other pertinent information, the usual signed declaration that rules and regulations have been observed, and your name and address in block letters.

Your entry must be postmarked no later than February 15th to: U.R.E. International Contest, P.O. Box 220, Madrid, Spain.

## Hungarian C.W. Contest

Starts: 1600 GMT Sat. Dec. 11
Ends: 1600 GMT Sun. Dec. 12

It's the world working the HA's on all bands 3.5 through 28 MHz on c.w. only.

Operation will be in three classes: Single operator, single band and all band, and multi-operator all band. (Club stations are considered multi-operator.)

**Exchange:** RST plus a contact number starting with 001. In addition, the HA's will send two letters to identify their county (BA, BP, BE, BO, CS, FE, GY, HA, HE, KO, NO, PE, SA, SO, SZ, TO, VA, VE, ZA, total of 20 on each band).

**Scoring:** One point for each HA contact, and a multiplier of one for each different county worked on each band. (Same station may be worked once on each band for QSO and multiplier credit.)

**Final Score:** Total QSO points from all bands times the sum of the county multiplier from each band.

**Awards:** Certificates to the first place winners in each class in each county.

Include a summary sheet with your entry including the usual signed declaration. Send within six weeks from the end of the contest to: Radio Amateur League of Budapest, P.O. Box 2, H-1553, Budapest, Hungary.

## ARRL 10 Meter Contest

Starts: 0000Z Sat., Dec. 11
Ends: 2400Z Sun., Dec. 12

This is the 10th annual 10 Meter contest organized by the ARRL. It has become very popular because of the choice of entries available, so plan your strategy while conditions still prevail.

It's a worldwide activity in which DX stations are permitted to work other DX stations. You are not limited to working W/K's and VE's only.

The same station may be worked once on phone and again on c.w.; no cross-mode, however. A maximum of 36 hours operating time is permitted out of the 48-hour contest period for all stations.

**Categories:** Single operator, mixed mode, phone only or c.w. only. Multi-operator mixed mode only.

**Exchange:** W/VE stations (including KH6 and KL7) send RS(T) and state or province. DX stations (including KH2, KP4, etc.) send RS(T) and QSO number starting with 001. Maritime mobiles send RS(T) and ITU region. Novice and Tech. stations must identify /N or /T.

**Scoring:** Two points per QSO; 4 points if it's with a Novice or Tech.

**Multiplier:** Fifty U.S. states, VE call areas, DX countries, and ITU regions.

**Final Score:** Total QSO points times the state, province, DX country, and ITU region multiplier.

**Awards:** Certificates to the top single operator in each category for each ARRL section and DX country, and to the top multi-operator station in each ARRL division and each continent.

Indicate the multiplier only the first time it is worked. Dupe sheets are required for logs with 500 or more QSO's. The usual disqualification criteria will be observed. A large s.a.s.e. will get you log and instruction forms. Mailing deadline for all entries is January 12th to: ARRL Communications Dept., 10 Meter Contest, 225 Main Street, Newington, CT 06111.

## U.B.A. SWL Competition

Jan. 1, 1983 to Dec. 31, 1983

This competition is open to all registered SWL's in the world organizations recognized by the IARU.

The ARRL country list will be used as the standard on all 5 bands 10 through 80 meters.

There are three categories: c.w., phone, and RTTY, single operator only. You are allowed to enter any one category or all three categories.

**Points and Multiplier:** Each country heard on each band is counted once for each band. However, each country counts only once as a multiplier regardless of how many times it is recorded.

To enter the contest it is necessary to report your points calculation (no log) at least 3 times during the year: March 1st, June 1st, and September 1st. Final submission is February 15th, 1984.

Make up your own log forms, 7 columns to the sheet: date, a column for each band, and a multiplier column. List calls of stations heard, each country once only on each band, but only use the country prefix in the multiplier column.

A summary sheet showing the scoring, etc., and signed declaration are requested.

It is strongly recommended that you send an addressed envelope and two IRCs for official log forms and instructions. Address all letters to the SWL Contest Manager: Marc Domen, ONL 6945, Gebr. Blommestraat 14, B-2200 Borgerhout, Antwerpen, Belgium.

### 1982 Helvetia Contest Results

| | | | |
|---|---|---|---|
| *K1KI | 34,200 | **Canada** | |
| W1END | 16,107 | *VE2CU | 7,134 |
| W1CNU | 4,590 | *CY1AW | 4,800 |
| W1WY | 3,600 | | |
| W1OPJ | 1,458 | **S. America** | |
| *W2BXA | 27,720 | *LU1EWL | 1,716 |
| K2SX | 18,624 | LU2DPW | 192 |
| K2QF | 4,662 | *OA4ZP | 1,350 |
| KA2DYB | 4,500 | *PY2EWZ | 810 |
| W2NU | 3,441 | *YV5HL | 5,472 |
| W2XQ | 3,150 | | |
| *W3ARK | 9,225 | **Africa** | |
| K3FN | 7,560 | *EA8TE | 1,596 |
| *W4KO | 3,600 | *EL8H | 1,188 |
| K4CSB | 2,673 | | |
| WA4OML | 2,304 | **Australia** | |
| W4KMS | 1,425 | *VK2BAC | 1,560 |
| *N5EA | 6,840 | | |
| WA5NUK | 4,830 | **Top Ten DX** | |
| KE5B | 1,425 | K1KI | 34,200 |
| WB5FXX | 858 | UG6GAF | 30,552 |
| W5EIJ | 168 | W2BXA | 27,720 |
| *W6UA | 2,886 | K2SX | 18,624 |
| K6DDO | 2,448 | UJ8JAS | 16,530 |
| W6ILH | 192 | W1END | 16,107 |
| W6ZT | 147 | UL7CT | 15,444 |
| *W7QK | 540 | JA1ADN | 15,288 |
| *W8DA | 10,290 | UM8MDX | 14,544 |
| K8ZR | 5,565 | JA9FAI | 14,241 |
| *WØBQ | 330 | | |
| WDØBZA | 48 | *Certificate winners* | |


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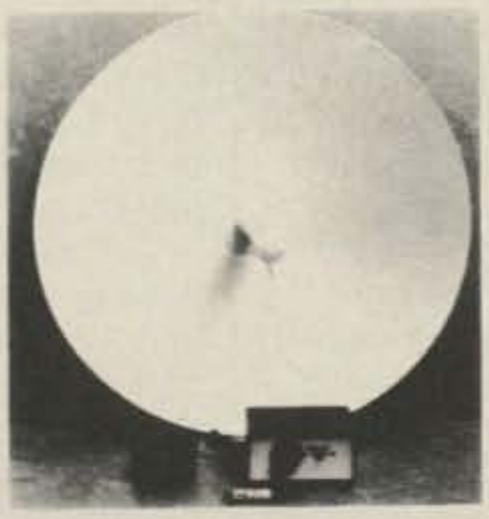

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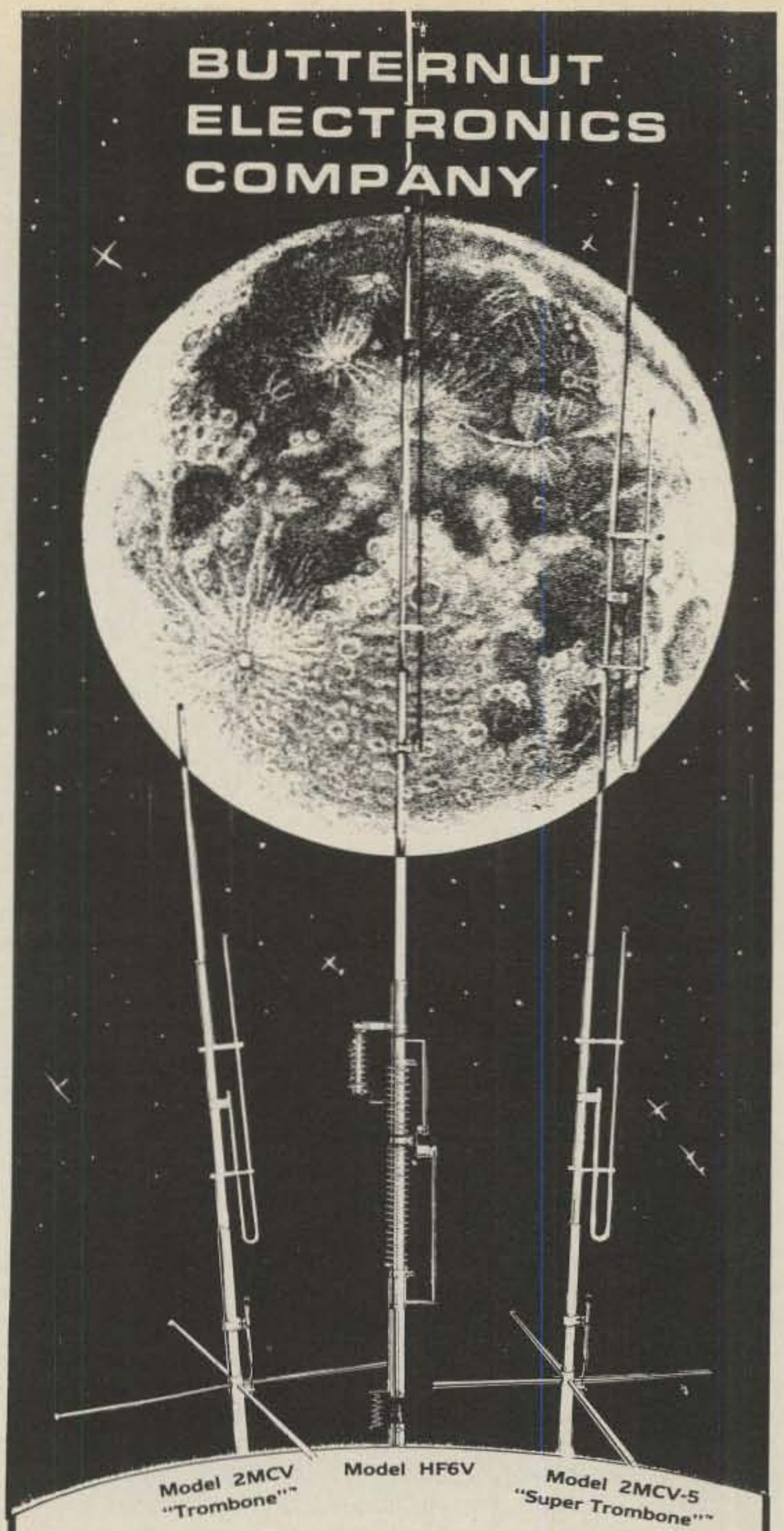


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**Please send all reader inquiries directly.**

# Antennas

*a monthly feature by*
**KARL T. THURBER, JR., W8FX**

DESIGN, CONSTRUCTION, FACT, AND EVEN SOME FICTION

## *Antenna Accessories for the Hamshack: Part III*

*Last month our columnist continued his series on antenna accessories with a discussion of the wattmeter and the s.w.r. bridge. This time, the spotlight is on two other in-line devices: the r.f. transformer and the balun.*

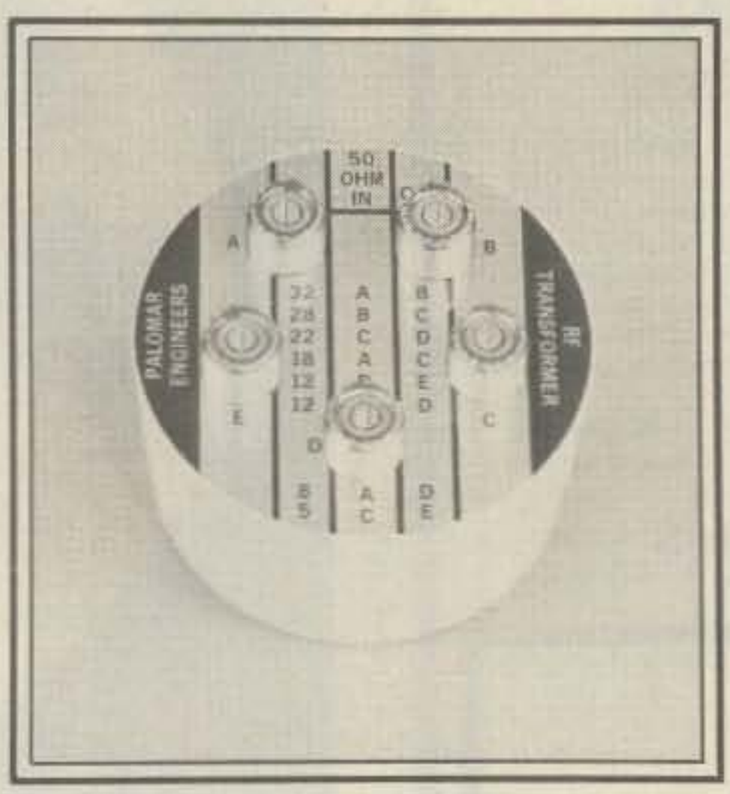
To date in this series on r.f. antenna accessories, we have examined a number of useful devices. These have included the dummy load, the r.f. wattmeter, and the s.w.r. bridge—all basic devices for proper transmitter tuneup and antenna adjustment. In this month's column, we will continue this discussion of in-line devices with a look at two other interesting devices: the r.f. transformer and balun. Let's first examine the r.f. transformer.

### The R.F. Transformer

This versatile device is a relative newcomer to the hamshack. Its popularity has increased considerably since the development of low-loss r.f. ferrite materials and winding techniques which permit efficient and compact designs capable of handling respectable power levels. The set-and-forget device also requires no tuning other than initial impedance-tap selection.

The typical r.f. transformer for h.f. operation matches the nominal 50-ohm transmitter output to a half-dozen or more fixed impedances, usually ranging from about 32 ohms down to about 5 or 10 ohms, over the range 1.8 or 3.5 MHz to 30 MHz, depending upon the particular model. While the r.f. transformer cannot handle a range of complex impedances with anything near the flexibility of the transmatch, the device is excellent where a fixed impedance transformation ratio is required. And, while anything put between the transmitter and antenna will have some power loss, the better units can handle the task with efficiencies well over 90% to provide an s.w.r. of under 1.5:1 while requiring no tuning or adjustment other than initial setup.

One of the big uses for the r.f. transformer is in the matching of vertical antennas to coaxial feedline, important since verticals typically show a very low resistance. This is usually on the order of about 32 ohms for a quarter-wave vertical with no reactance. To match such an antenna to the transmitter through standard 50 ohm coaxial cable is a fairly simple matter of connecting a suitable r.f. transformer at the base of the antenna and setting the impedance selection switch at 32 ohms, or at the closest available setting; if the antenna is exhibiting the proper characteristics, a near 1:1 match should be the result.




*Heavy-duty r.f. transformer shown here is capable of matching a 50 ohm source to 32, 28, 22, 18, 12, 8, or 5 ohms, depending on the specific tap selected. Power-handling capability is 2000 watts (6 kw PEP) over the range 1–30 MHz (1–10 MHz when working below 15 ohms). The unit has an r.f. ferrite core, teflon insulation, and sealed construction. (Photo courtesy Palomar Engineers)*

A shorter antenna will have a lower resistance and will exhibit capacitive reactance. For example, a 2/10-wavelength vertical will show a resistance on the order of 18 ohms, and a capacitive reactance that can be tuned out through the use of a loading coil. The short vertical is adjusted by first resonating the antenna with the loading coil installed, which should result in the antenna showing a base impedance of 18 ohms, resistive. The transformer tap or switch is then set at the nearest tap for a low-s.w.r. match to the transmission line to complete the match.

It's possible to make especially good use of the r.f. transformer with solid-state, broadband transmitters and transceivers, since you can generally eliminate the need for an antenna tuner or transmatch to compensate for antenna impedance variations. Thus, the number of antenna matching and loading knobs required to be adjusted when changing frequency is reduced.

Another important use for the r.f. transformer is in h.f. mobile operation, where it's often difficult to get the s.w.r. on the whip down to a tolerable level because of the very low base impedances usually encountered. Specialized, compact r.f. transformers are available that can help solve that problem by matching the low impedance of the loaded whip to the nominal 50 ohms required by most solid-state transceivers.

In mobile operation, the r.f. transformer is usually mounted as close as possible to the base of the whip in the trunk. Tuning is accomplished by first adjusting the loading coil or other resonating device to the desired frequency and observing the s.w.r. obtained on the transmission line. The r.f. transformer is then installed close to the base of the whip, and the transmitter is keyed at a low power level on each of the available tap or switch positions on the r.f. transformer. The setting that results in the lowest s.w.r. should be used; this should be recorded, as the tap setting would be expected to change when changing bands. Note that one should not "hot-switch" from one tap position or setting to the next with the transceiver putting forth r.f.—at the risk of serious damage to both transceiver and matching device.

While the r.f. transformer has been discussed primarily in terms of its use as a *step-down* device, most units may also be used to match a 50 ohm transmitter output to a *higher* antenna impedance by reversing the connections to the r.f. transformer. Used in this manner, the transmitter would be connected to the "antenna" or "output" connector, and the antenna would be connected to the "transmitter" or "input" connector.

For the purpose of illustration, using the tap settings of 50, 38, 28, 19, 12, 7, and 3 ohms available on the Swan/Cubic "MMBX" Matchbox, if the antenna impedance is known, the step-up impedance ratios in the table below may be used to determine the correct switch or tap position. For example, if the antenna impedance is 72 ohms, the ratio of 50:72 is 1:1.44. The available 1:1.3 ratio, which is obtained by placing the switch to the 38 ohm position, will provide the closest approximate impedance match. Of course, if the antenna impedance isn't known, then an s.w.r. meter should be used to determine the position on the r.f. transform-

*317 Popular Drive, Millbrook, AL 36054



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er that produces the lowest s.w.r. Here's the table described above:

**Step-Up Impedance Ratios**

| | |
|---|---|
| 3 ohms | 1:16 |
| 7 ohms | 1:7.1 |
| 12 ohms | 1:4 |
| 19 ohms | 1:2.6 |
| 28 ohms | 1:1.8 |
| 38 ohms | 1:1.3 |
| 50 ohms | 1:1 |

This example has only considered a transmitter output of 50 ohms. Most r.f. transformers can be used with any reasonable transmitter output impedance, since the device is simply a transformer with selectable turn ratios and can be used, as described above, to match antenna impedances that are higher or lower than the transmitter impedance. When used with transmitter outputs *other than* the nominal 50 ohms usually encountered, the ratios in the table below can be used to determine the switch/tap position for matching an antenna of lower impedance than the transmitter, again using Swan/Cubic ratios as examples.

**Step-Down Impedance Ratios**

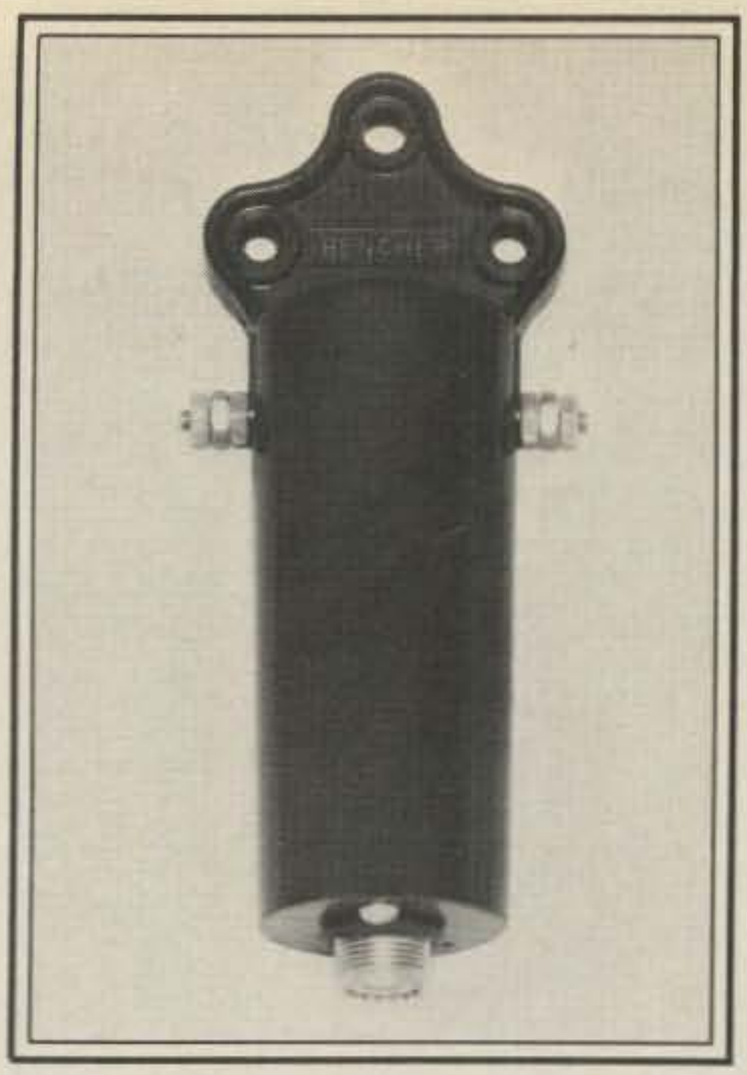
| | |
|---|---|
| 50 ohms | 1:1 |
| 38 ohms | 1.3:1 |
| 28 ohms | 1.8:1 |
| 19 ohms | 2.6:1 |
| 12 ohms | 4:1 |
| 7 ohms | 7.1:1 |
| 3 ohms | 16:1 |

By the same token, an antenna of higher impedance than the transmitter may be matched to a transmitter of other than 50 ohms (such as 72 ohms) using the step-up ratios shown in the first table. For example, using this same unit, given a transmitter output of 72 ohms and an antenna impedance of 300 ohms, the desired step-up ratio is 1:4.16. By consulting the step-up table, we find that the best match is found by setting the tap at the 12 ohm position, since this provides a close enough 1:4 impedance step-up. Simple!

Many other impedance combinations can be obtained, and other uses can be found for these handy r.f. devices. However, they can't necessarily take the place of a good, wide-range transmatch, where flexibility is paramount, and they can't be expected to perform the specialized functions of the balun—which brings us to the next area of discussion.

## The Balun

This device is closely related in function to both the transmatch and the r.f. transformer. The balun, derived from "balanced-to-unbalanced," is a special kind of matcher that transforms an unbalanced transmission line condition (one side at ground potential) to a balanced one (neither conductor at ground potential) in order to maintain overall system "balance" and reduce line radiation. Whereas coaxial cable is now the most commonly used transmission line, many amateurs prefer to use openwire or twinlead lines; both of these are considered to be "balanced." Mounted at the transmitter, the balun allows the coaxial output, standard on most transmitters and transceivers, to be adapted to these balanced lines. The balun can also be mounted at the antenna itself to enable coaxial feedline to be effectively coupled to inherently balanced antennas, such as dipoles and most beams.



*Bencher balun shown here is "pull tested" at 600 lbs. of antenna load, is rated at 5 kw peak power, and is fabricated of insulated, heavy-gauge, solid copper wire with an interwinding insulation of greater than 6000 volts. A ferrite core is not used in this design, which is said to be free of problems of saturation and loss at higher frequencies. Two models are available: the ZA-1, which is designed for 3.5–30 MHz operation, and the SA-2, which is optimized for 14–30 MHz and which includes stainless steel and aluminum hardware for a 2-inch boom. (Photo courtesy Bencher, Inc.)*

The simplest balun is the "1:1" kind—that is, one that has the same impedance at its input side as that at its output side; there is no transformer action (step-up or step-down) involved. On the other hand, the popular "4:1" balun is *also* a transformer: it is used both as a step-down device, as well as a means of converting balance conditions. The former type of balun is usually used to feed simple dipoles and beam antennas with coaxial cable, while the latter is frequently used to feed antennas such as folded dipoles and quads. Several transmatch designs include built-in baluns for direct feeding of openwire or twinlead transmission lines—more on this later.

The term "balun" actually describes a *class* of balancing devices all having the purpose of maintaining symmetry or balance in the antenna and feeder system and detuning or decoupling the line for "antenna" currents in order to reduce or eliminate unwanted feedline radiation. Several forms of linear (transmission-line section) balun using metal sleeves or actual line sections have been developed to prevent unbalanced currents from flowing on the outside of the transmission line when a coaxial feeder is used in connection with an inherently balanced antenna, such as a dipole. One such classic arrangement is the *bazooka,* which makes use of an electrical quarter-wavelength sleeve installed over the coaxial transmission line at the antenna. While decoupling the antenna from the transmission line, this device has no effect on the impedance relationships between the antenna and the coaxial line. Another popular design is the half-wave phasing section, used to couple between an unbalanced and balanced circuit when a 4:1 impedance ratio is required. Other variations are possible.[1]

Linear baluns are cumbersome and are not well-suited to multiband operation. More convenient are **coil and toroidal baluns.** The **coil balun** is, in effect, a variation of the linear balun in which the transmission line is wound into coils. Actually, a definite line length is necessary only for purposes of decoupling (the length of line in each coil should be about equal to a quarter-wavelength at the lowest frequency to be used). As long as there is sufficient decoupling, the system will serve as a 4:1 ratio impedance transformer regardless of line length. With each line wound into a coil, the inductances formed will act as chokes to isolate the "balanced" end from any ground connection that is placed on the "unbalanced" end. This type of balun will operate over a wide range of frequencies, since choke inductances are not critical.

Most air-wound baluns are rather bulky when designed for operation in the popular h.f. ranges of 1.8 to 30 MHz and don't lend themselves well to outdoor use. More compact baluns can be constructed by using **toroidal ferrite core** material as a foundation for bifilar-wound coil balun transformers. It's a fairly simple matter to design the toroidal balun with various impedance-transformation ratios so that the balun can effectively do double-duty as a precision transformer as well as a balance transformation device. Baluns having 1:1 and 4:1 ratios are the most common ones, being used either for adapting 50 or 75 ohm transmission lines to feed dipoles or allowing these lines to feed 300 ohm folded dipoles and similar balanced antennas. Popular commercially available ratios also include 1.5:1, 2:1, 3:1, 5:1, 6:1, 7.5:1, 9:1, 12:1, and

[1] *Various balun construction details are provided in the ARRL* Handbook *on pp. 19-6 through 19-9 in the 1981 edition.*

16:1. These ratios would, for example, be used mach 50 ohm transceiver outputs to antennas having impedances of 75, 100, 150, 250, 300, 375, 450, 600, and 800 ohms, respectively.

While the broadband toroidal or solenoidal (doughnut or rod-shaped) balun is a convenient, handy device, it must be of high-quality construction and used properly, lest severe losses develop. A poorly designed balun, or one using low-quality core material, can ruin an antenna system rather than improve it; any reactance that the balun introduces can cause the overall s.w.r. to be *higher* than that which existed at antenna resonance before the balun was installed. Also, the balun must "look into" a purely resistive load. If the balun is required to work into a highly reactive, complex load, core losses in the balun increase to an excessive degree. Also, working into an improper (high s.w.r.) load can result in balun failure. If the s.w.r. is high due to high impedances, voltages soar and may cause a breakdown of the interwinding insulation—an irreversible condition. Conversely, very low impedances cause the power handled to be transformed to very low voltages at excessive currents, to the extent that the windings of the balun overheat, possibly causing the insulation to fail or even the case to melt. A saturated ferrite core can reradiate harmonic energy and may even cause t.v.i. For these reasons, several firms have developed special, compact *air-core* baluns that eliminate many of these problems.

Because of the extra versatility the balun adds to transmatch capabilities, many manufacturers include a balun as a built-in device. This is highly useful, but the assumption is that the antenna system will be of a known impedance—not always the case, especially with multiband antennas using so-called "tuned" feeders. As explained previously, a balun should be used *only* at or near its design impedance. Most transmatches place the balun at the tuner *output* in order to convert

*"Classic" balun design is exemplified by the W2AU balun shown here. Unit has a range of 3–40 MHz, handles 2 kw PEP, and includes a built-in hang-up hook (for use with inverted Vees). A 1:1 model is shown, which is intended for use with antennas having 50–75 ohm feedpoints. A 4:1 balun is available for folded dipoles. (Photo courtesy Unadilla/Reyco)*

the unbalanced tuner output to a balanced one for open-wire lines. However, the impedance of the balanced line in multiband systems can vary from but a few ohms up to several thousand ohms. A balun designed for, say, 300 ohms will actually see impedances far different from that. The results can include high losses in the balun and imbalance in the system, since a balun with high losses doesn't do the job it is supposed to do.

In an attempt to rectify this situation, Palomar Engineers took an interesting step in placing a 1:1 50 ohm balun at the *input* of its PT-2500A antenna tuner. As a result, the tuner input is always 50 ohms when it is properly tuned so that the balun sees its exact design impedance, resulting in minimal losses and good balance. As recognition of balun losses increases, we may expect to see more examples of this type of "front end" balun use.

Whether or not a balun is required in your antenna system will depend on the specific type of antenna you are using and what you are attempting to accomplish with the system. Frankly, the ordinary half-wavelength dipole for the h.f bands can be *directly* fed by coaxial cable without serious ill effects if the antenna is adjusted for a low s.w.r.; and a balun would not be used with ground-mounted verticals, ground planes, and mobile whips, or with gamma-matched or Omega-matched quads and Yagis. But in most cases, when an unbalanced coaxial feed is used in conjunction with a balanced antenna, overall results will be improved if a balun is used. These types of antennas include inverted Vees, direct-fed quads, Yagis requiring a balanced feed, beta-matched Yagis, and the like.

In any case, the balun won't yield an increase in radiated power or significantly improve reception. Some side benefits, however, include slightly enhanced lightning protection (from internal spark gaps and/or the device being at d.c. ground potential), as well as mechanical features such as the convenient mounting or hang-up hook found on most models. Not the least, in large directive arrays the balun is extremely useful in maintaining a proper balance condition to reduce line radiation which could spoil the directional pattern of the array; this would be especially serious in v.h.f. and u.h.f. systems. These undesirable out-of-balance effects would also be noticeable on reception, although probably not to as great an extent as on transmission. In addition, the indirect benefits of reduced line radiation include reduced tendencies to r.f.i., t.v.i., and b.c.i. effects, mostly as a result of lowered "antenna" currents on the transmission line and consequent line radiation.

A final point: Contrary to some beliefs, a balun *can* be used in an antenna system if a transmatch is employed at the transceiver or transmitter end. Some amateurs are of the mistaken opinion that baluns and transmatches "don't mix," but this is not true. Problems do arise, however, if the transmatch is used to compensate for a poorly matched antenna system, in which case the balun may be damaged for the reasons already discussed.

## Summing Up

In this month's Antennas Column, we have added to our list of antenna accessories with an examination of the r.f. transformer and the balun. In subsequent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## Antenna of the Month The Cushcraft R-3

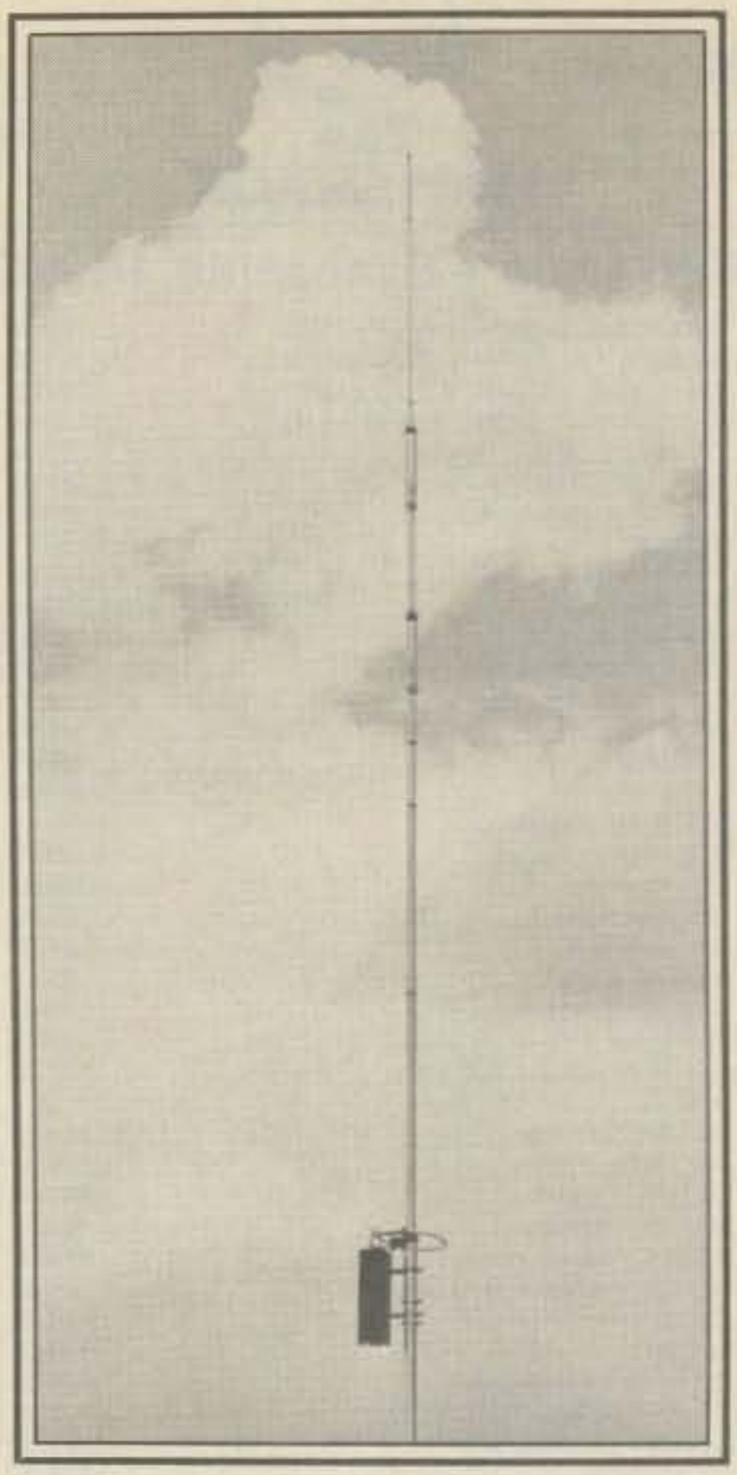
The Cushcraft R-3 antenna represents an unusual departure in h.f. verticals. Designed for 10, 15, and 20 meter operation, it is essentially a half-wave, end- or base-fed vertical that uses both resonating traps and a remote tuned tapped parallel resonant circuit for impedance matching (*a la* the Ringos). The end-fed, base-matched design does away with the need for radials, thus making the antenna suitable for many installations in which a quarter-wave vertical would not be suitable or practical.

The antenna consist of two resonating traps, three vertical sections, a ring section/matching network assembly, a motorized capacitor tuning assembly, mounting clamp, and remote control box. All this enables an s.w.r. of 1.5:1 or less to be attained over all of 20 and 15 meters, with somewhat lesser range on 10 meters. The base tuning network functions continuously over 12 to 30 MHz, so the new WARC 18 and 24 MHz bands can be accommodated using extender kits that Cushcraft ultimately intends to provide.

Careful attention was paid to avoiding r.f. on the feedline based on experience gained from the popular Ringo v.h.f. series. The outcome was the multiple tapped inductor and tuning network visible in the photo. Other simpler systems, it was found, could not keep r.f. off of the feedline on all bands. Still, the coax and rotor wires should be routed down from the R-3 as far as possible to avoid placing the cables in the "doughnut" radiation lobe.

The R-3's design is adaptable to many environments that would make other antennas impractical. Large metal objects such as buildings, gutter pipes, other antennas, etc., will detune any antenna, but the R-3 can be optimized by retuning the base tuning network (using the remote-control box) to counteract any local obstructions. If the obstructions are big enough to prevent an adequate match from being obtained, then the element lengths can be readjusted for best match—much like adjusting a conventional trap vertical. The flexible tuning scheme can also counteract the effects of large amounts of snow and ice.

According to Dave Olean, K1WHS, of Cushcraft, the efficiency question is a tough one, because it depends on the peculiarities of each installation to a great extent. Generally, the best approach is to install the antenna as high and in the clear as possible. A ground-mounted R-3 will suffer from some ground loss, although no quantitative tests have been made. Nevertheless, it's fairly safe to say that the R-3 will usually show a marked advantage over a *typical* quarter-wave vertical that is ground mounted, and which uses a limited number of radials. Most hams (your columnist included) tend to avoid radials like the plague, and as a result suffer the consequences of 10–25% efficiencies. According to Dave, an R-3 on a mast or chimney with no radials will run circles around other verticals with only a few sets of radials. Of course, a properly installed quarter wave with a low-loss grid of 60 to 80 long radials is a different story: the efficiency and low angle of radiation of such an antenna is topnotch, but represents an extremely difficult antenna to install.



*Cushcraft R-3 triband vertical is shown installed at author's QTH, being mounted on a small TV-type peak mount. "Business end" of the R-3 antenna shows the method of mounting to a mast or pipe; the base section will conveniently fit over a 1⅞" O.D. tube, although for portable or apartment-style operation, no mount is required. Author used four guy wires to secure the mast, but these are not intended to function as radials. (W8FX photo)*

In the author's installation, cross-comparisons were made with a multiband dipole on the three bands (rather than against another vertical). Over DX paths, as expected, the R-3 outperformed the horizontal 80–90% of the time, with signals sometimes 12–15 dB stronger on the former. Results were mixed on short-haul work, with the vertical favored for local work on 10 meters.

Antenna installation was simple and easy. However, four-conductor rotor cable is required between control box and antenna; early ads didn't mention the need for the rotor cable. The new RG-8X coax was used, which should be suitable for all but the very highest power levels.

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columns we will continue our discussion with a look at other in-line devices, including r.f.i. filters, lightning protective devices, and r.f. switches, before turning to peripheral devices—those not directly in the path of r.f. from the transmitter to the antenna. See you then.

73, Karl, W8FX

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# Propagation

*a monthly feature by*
**GEORGE JACOBS, W3ASK**

## THE SCIENCE OF PREDICTING RADIO CONDITIONS

### Bulletin

Since this issue of *CQ* will reach most subscribers before the *CQ* World Wide DX C.W. Contest weekend of November 27–28, here is an updated day-to-day forecast for that weekend. Low Normal conditions are expected on the 27th, with periods dropping to Below Normal, mainly on paths passing through the high latitudes. Conditions are expected to improve considerably on the 28th, with High Normal forecast for most of the period throughout most of the world.

The year 1982 will go down in the record books as another good year for propagation conditions on the h.f. amateur bands. The sunspot cycle continued its slow decline during the year, but remained at a relatively high level. While all necessary data is not yet available, it looks as if the year began with a smoothed sunspot number of 137 and dropped to approximately 100 by the end of the year.

The Royal Observatory of Belgium reports a monthly mean sunspot number of 106 for August 1982. This results in a smoothed sunspot number of 133 centered on February 1982. This is a drop of four points in the sunspot cycle from January's level of 137. A smoothed sunspot number of approximately 100 is forecast for December 1982.

### December Band Openings

During December, the density of ionization in the northern hemisphere is expected to increase more rapidly after sunrise than during other seasons. Atmospheric noise and static levels should be at seasonally low values during the month, and signal levels are expected to be exceptionally strong during many band openings.

Excellent *daytime* DX openings to most areas of the world should be possible on *10, 15,* and *20* meters. Some *6* meter DX openings may also be possible during the daylight hours, particularly when conditions are expected to be High or Above Normal. This may be the last winter season during which solar activity is high enough to support *6* meter DX openings for the present sunspot cycle.

From *sundown* to *midnight* check *15* and *20* meters for DX openings towards the south and the west. For openings towards the east and the south during this period, check *40* and *80* meters. Some fairly good DX openings should also be possible on *160* meters from locations in the eastern half of the country towards the north, east, and south.

From *midnight* to *sunrise,* both *40* and *80* meters should be the best DX bands to most areas of the world. Some *20* meter openings should be possible towards the west and south, often with strong signals. Also check the *160* meter band for openings towards the south and west.

To optimize DX openings on *40, 80,* and *160* meters remember that signals peak just as the sun begins to *rise* at the *easternmost* terminal of a path.

Short-skip conditions during December favor the *40* and *80* meter bands for daytime openings less than 250 miles in length. Try *80* and *160* meters for this same distance at night. For openings between 250 and 750 miles, *40* meters should be optimum during the day, and both *80* and *160* meters at night. Try *20* meters during the day for openings between 750 and 1300 miles, *40* or *80* meters from sunset to midnight, and *80* meters from midnight through the sunrise period. Try *40* meters again for an hour or so after sunrise. For openings between 1300 miles and the maximum one-hop distance of 2300 miles, either *15* or *20* meters should be optimum during the day, *20* and *40* meters from sundown to midnight, and *40* and *80* meters from midnight to sunrise. *Ten* meters should also provide good short-skip openings between 1300 and 2300 miles during much of the daylight period.

This month's column contains DX Propagation Charts valid through mid-February 1983. Short-Skip Propagation Charts for December appeared in last month's column.

### V.H.F. Ionospheric Openings

Solar activity is still high enough that some *6* meter DX openings may be possible during December. This will probably be the last year, however, for such openings for the remainder of this solar cycle. Check for openings towards Europe, Africa, and the east for an hour or two before noon. These openings, if they will occur at all, should favor locations in the eastern half of the country. Openings towards the Pacific, Australasia, and the Far East favor locations in the western half of the country and may occur during the late afternoon and until just before sundown. Openings towards Central and South America and the Caribbean area should be possible from about an hour or two before, to about an hour after, noon. Generally, *6* meter openings are most likely to occur at about the same time that 10 meter conditions are peaking for a particular transmission path.

A major meteor shower, the Geminids, is expected during the second week of December, reaching peak intensity between the 12th and 13th with a meteor count of approximately 60–70 an hour. A second, but less intense, shower, the Ursids, is scheduled to peak between December 21–22, with a meteor count of approximately 15 an hour. Both showers should produce brief periods of ionization which may make possible short-skip openings on the v.h.f. bands for distances up to approximately 1300 miles.

December is not an optimum month for trans-equatorial scatter propagation. An occasional *6* meter opening, however, may be possible via this mode towards South America. The best time to check for TE openings is during the evening hours between 8 and 11 p.m. local time. Openings, if they should occur at all, will favor locations in the southern tier states.

### LAST MINUTE FORECAST

***Day-to-Day Conditions Expected for December 1982***

| Propagation Index | Expected Signal Quality (4) | (3) | (2) | (1) |
|---|---|---|---|---|
| Above Normal: 1, 13, 28 | A | A | B | C |
| High Normal: 2, 5, 14, 18-19, 25, 27, 29 | A | B | C | C-D |
| Low Normal: 3-4, 6-7, 10-12, 17, 23-24, 30-31 | A-B | B-C | C-D | D-E |
| Below Normal: 8-9, 15-16, 20, 22, 26 | B-C | C-D | D-E | E |
| Disturbed: 21 | C-E | D-E | E | E |

***Where expected signal quality is:*** **A—Excellent opening, exceptionally strong, steady signals greater than S9 + 30 dB.**

**B—Good opening, moderately strong signals varying between S9 and S9 + 30 dB, with little fading or noise.**

**C—Fair opening, signals between moderately strong and weak, varying between S3 and S9, with some fading and noise.**

**D—Poor opening, with weak signals varying between S1 and S3, and with considerable fading and noise.**

**E—No opening expected.**

#### HOW TO USE THIS FORECAST

1. **Find *propagation index* associated with particular band opening from Propagation Charts appearing on the following pages.**
2. **With the *propagation index*, use the above table to find the expected signal quality associated with the band opening for any day of the month. For example, an opening shown in the charts with a *propagation index* of 3 will be excellent (A) on Dec. 1st, good (B) on the 2nd, good-to-fair (B-C) on the 3rd and 4th, good (B) on the 5th, etc.**

***For updated information, subscribe to bi-weekly MAIL-A-PROP, David D. Meisel, Editor, 54 Westview Crescent, Geneseo, NY 14454.***

*11307 Clara St., Silver Spring, MD 20902*

Some aurora-type v.h.f. ionospheric openings are likely to occur during December for distances up to approximately 1300 miles particularly when conditions on the h.f. bands are expected to be Below Normal or Disturbed. Check the Last Minute Forecast at the beginning of this column for those days during the month that are expected to be in these categories.

The combination of intense *F-2* layer ionization and an expected seasonal increase in sporadic-*E* propagation should result in some short-skip openings on the *6* meter band. These openings likely will range between approximately 1100 and 2300 miles.

The Editor of this column would like to take this opportunity to extend his warmest wishes for the Holiday Season to readers everywhere.

73, George, W3ASK

### HOW TO USE THE DX PROPAGATION CHARTS

1. Use Chart appropriate to your transmitter location. The Eastern USA Chart can be used in the 1, 2, 3, 4, 8 KP4, KG4 and KV4 areas in the USA and adjacent call areas in Canada; the Central USA Chart in the 5, 9 and 0 areas; the Western USA Chart in the 6 and 7 areas, and with somewhat less accuracy in the KH6 and KL7 areas.

2. The predicted times of openings are found under the appropriate meter band column (10 through 80 Meters) for a particular DX region, as shown in the left hand column of the Charts.

3. The *propagation index* is the number that appears in ( ) after the time of each predicted opening. The index indicates the number of *days* during the month on which the opening is expected to take place as follows:

(4) Opening should occur on more than 22 days
(3) Opening should occur between 14 and 22 days
(2) Opening should occur between 7 and 13 days
(1) Opening should occur on less than 7 days

Refer to the "Last Minute Forecast" at the beginning of this column for the actual *dates* on which an opening with a specific *propagation index* is likely to occur, and the signal quality that can be expected.

4. Times shown in the Charts are in the 24-hour system, where 00 is midnight; 12 is noon; 01 is 1 A.M.; 13 is 1 P.M. wetc. Appropriate *daylight* time is used, *not* GMT. T convert to GMT, add to the times shown in the appropriate chart 7 hours in PDT Zone, 6 hours in MDT Zone, 5 hours in CDT Zone, and 4 hours in EDT Zone. For example, 14 hours in Washington, D.C. is 18 GMT. When it is 20 hours in Los Angeles, it is 03 GMT, etc.

5. The charts are based upon a transmitted power of 250 watts c.w., or 1 kw, p.e.p. on sideband, into a dipole antenna a quarter-wavelength above ground on 160 and 80 meters, and a half-wavelength above ground on 40 and 20 meters, and a wavelength above ground on 15 and 10 meters. For each 10 db gain above these reference levels, the *propagation index* will increase by one level for each 10dB loss, it will lower by one level.

6. Propagation data contained in the Charts has been prepared from basic data published by the Institute for Telecommunication Sciences of the U.S. Dept of Commerce, Boulder, Colorado, 80302.

## December 15, 1982-February 15, 1983
## Time Zone: EST (24-Hour Time)
## EASTERN USA TO:

| | *10/6 Meters* | *15 Meters* | *20 Meters* | *40/80 Meters* |
|---|---|---|---|---|
| Western & Central Europe & North Africa | 07-08 (1)<br>08-09 (2)<br>09-13 (4)<br>13-14 (2)<br>14-15 (1)<br>09-11 (1)** | 06-07 (1)<br>07-08 (2)<br>08-14 (4)<br>14-15 (2)<br>15-16 (1) | 03-06 (2)<br>06-07 (3)<br>07-09 (4)<br>09-10 (3)<br>10-12 (2)<br>12-13 (3)<br>13-16 (4)<br>16-18 (3)<br>18-21 (2)<br>21-23 (1)<br>23-01 (2)<br>01-03 (3) | 14-16 (1)<br>16-17 (2)<br>17-19 (3)<br>19-02 (4)<br>02-03 (3)<br>03-04 (2)<br>04-05 (1)<br>17-19 (1)*<br>19-20 (2)*<br>20-02 (3)*<br>02-03 (2)*<br>03-04 (1)* |
| Northern Europe & European USSR | 07-08 (1)<br>08-09 (3)<br>09-10 (4)<br>10-11 (2)<br>11-12 (1)<br>08-10 (1)** | 06-07 (1)<br>07-08 (2)<br>08-09 (3)<br>09-11 (4)<br>11-12 (3)<br>12-13 (2)<br>13-14 (1) | 04-06 (1)<br>06-07 (2)<br>07-09 (3)<br>09-14 (2)<br>14-16 (3)<br>16-18 (4)<br>18-20 (3)<br>20-23 (2)<br>23-02 (1) | 17-19 (1)<br>19-01 (2)<br>01-03 (1)<br>19-02 (1)* |
| Eastern Mediterranean & Middle East | 07-08 (1)<br>08-09 (3)<br>09-11 (4)<br>11-12 (3)<br>12-13 (2)<br>13-14 (1)<br>09-11 (1)** | 07-08 (1)<br>08-09 (2)<br>09-11 (4)<br>11-14 (3)<br>14-15 (2)<br>15-16 (1) | 07-10 (1)<br>10-13 (2)<br>13-16 (3)<br>16-18 (4)<br>18-22 (3)<br>22-01 (2)<br>01-03 (1) | 18-20 (1)<br>20-22 (2)<br>22-00 (3)<br>00-01 (2)<br>01-02 (1)<br>20-00 (1)* |
| Western Africa | 07-08 (1)<br>08-09 (2)<br>09-12 (3)<br>12-16 (4)<br>16-17 (3)<br>17-18 (2)<br>18-19 (1)<br>08-10 (1)** | 05-06 (1)<br>06-08 (2)<br>08-14 (3)<br>14-19 (4)<br>19-20 (3)<br>20-22 (2)<br>22-23 (1) | 03-04 (3)<br>04-06 (2)<br>06-13 (1)<br>13-15 (2)<br>15-17 (3)<br>17-00 (4)<br>00-01 (3)<br>01-03 (2) | 18-20 (1)<br>20-23 (2)<br>23-01 (3)<br>01-03 (2)<br>03-04 (1)<br>22-03 (1)* |
| Eastern & Central Africa | 08-09 (1)<br>09-11 (2)<br>11-13 (3)<br>13-15 (4)<br>15-16 (3)<br>16-17 (2)<br>17-18 (1)<br>08-10 (1)** | 06-08 (1)<br>08-12 (2)<br>12-14 (3)<br>14-17 (4)<br>17-18 (3)<br>18-19 (2)<br>19-20 (1) | 01-04 (2)<br>04-06 (1)<br>06-08 (2)<br>08-14 (1)<br>14-16 (2)<br>16-17 (3)<br>17-23 (4)<br>23-01 (3) | 18-21 (1)<br>21-23 (2)<br>23-01 (1)<br>21-00 (1)* |
| Southern Africa | 07-08 (1)<br>08-11 (3)<br>11-14 (4)<br>14-15 (3)<br>15-16 (2)<br>16-17 (1)<br>08-10 (1)** | 06-08 (1)<br>08-11 (2)<br>11-13 (3)<br>13-16 (4)<br>16-18 (3)<br>18-19 (2)<br>19-20 (1) | 06-08 (1)<br>12-14 (1)<br>14-15 (2)<br>15-17 (3)<br>17-20 (4)<br>20-00 (3)<br>00-02 (2)<br>02-04 (1) | 18-19 (1)<br>19-22 (2)<br>22-00 (1)<br>19-22 (1)* |
| Central & South Asia | 08-09 (1)<br>09-10 (2)<br>10-11 (1)<br>17-19 (1) | 07-08 (1)<br>08-10 (2)<br>10-11 (1)<br>17-19 (1) | 06-07 (1)<br>07-09 (3)<br>09-10 (2)<br>10-11 (1)<br>17-19 (1)<br>22-23 (1)<br>23-00 (2)<br>00-01 (1) | 06-08 (1)<br>18-20 (1) |
| Southeast Asia | 09-11 (1)<br>11-14 (2)<br>14-15 (1)<br>18-19 (1)<br>19-20 (2)<br>20-21 (1) | 09-10 (1)<br>10-12 (2)<br>12-13 (1)<br>18-19 (1)<br>19-21 (2)<br>21-22 (1) | 06-07 (1)<br>07-09 (2)<br>09-11 (1)<br>16-18 (1)<br>18-21 (2)<br>21-23 (1) | 05-07 (1)<br>17-19 (1) |

Indicates best times to listen for 80 Meter openings. Openings on 160 Meters are also likely to occur during those times when 80 Meter openings are shown with a Propagation Index of (2), or higher.

**Indicates best times to listen for F-2 layer openings on 6 Meters.

| | | | | |
|---|---|---|---|---|
| Far East | 17-18 (1)<br>18-19 (3)<br>19-20 (2)<br>20-21 (1) | 09-11 (1)<br>16-17 (1)<br>17-18 (2)<br>18-19 (4)<br>19-20 (3)<br>20-21 (2)<br>21-22 (1) | 00-04 (2)<br>04-07 (1)<br>07-09 (2)<br>09-11 (1)<br>16-18 (1)<br>18-19 (2)<br>19-22 (3)<br>22-00 (2) | 04-05 (1)<br>05-07 (2)<br>07-08 (1)<br>05-07 (1)* |
| South Pacific & New Zealand | 10-13 (1)<br>13-15 (2)<br>15-16 (3)<br>16-19 (4)<br>19-20 (2)<br>20-21 (1)<br>17-19 (1)** | 08-09 (1)<br>09-11 (2)<br>11-15 (1)<br>15-17 (2)<br>17-18 (3)<br>18-20 (4)<br>20-21 (3)<br>21-22 (2)<br>22-23 (1) | 12-19 (1)<br>19-21 (2)<br>21-22 (3)<br>22-02 (4)<br>02-04 (3)<br>04-07 (2)<br>07-10 (3)<br>10-12 (2) | 00-02 (1)<br>02-03 (2)<br>03-07 (3)<br>07-08 (2)<br>08-09 (1)<br>03-05 (1)*<br>05-07 (2)<br>07-08 (1)* |
| Australasia | 06-10 (1)<br>10-11 (2)<br>11-12 (1)<br>15-16 (1)<br>16-17 (2)<br>17-18 (3)<br>18-19 (4)<br>19-20 (2)<br>20-21 (1)<br>17-19 (1)** | 09-10 (1)<br>10-12 (2)<br>12-15 (1)<br>15-18 (2)<br>18-19 (3)<br>19-21 (4)<br>21-22 (2)<br>22-23 (1) | 07-09 (3)<br>09-11 (2)<br>11-14 (1)<br>16-18 (2)<br>20-22 (1)<br>22-00 (2)<br>00-05 (3)<br>05-07 (2) | 03-05 (1)<br>05-08 (2)<br>08-09 (1)<br>05-08 (1)* |
| Caribbean, Central America & Northern Countries of South America | 07-08 (1)<br>08-09 (3)<br>09-17 (4)<br>17-18 (3)<br>18-19 (2)<br>19-20 (1)<br>09-11 (1)** | 06-07 (1)<br>07-08 (3)<br>08-19 (4)<br>19-20 (3)<br>20-21 (2)<br>21-22 (1) | 07-09 (4)<br>09-11 (3)<br>11-14 (2)<br>14-16 (3)<br>16-00 (4)<br>00-02 (3)<br>02-06 (2)<br>06-07 (3) | 17-18 (1)<br>18-19 (2)<br>19-20 (3)<br>20-04 (4)<br>04-05 (3)<br>05-06 (2)<br>06-07 (1)<br>19-20 (1)*<br>20-22 (2)*<br>22-02 (3)*<br>02-04 (2)*<br>04-06 (1)* |
| Peru, Bolivia, Paraguay, Brazil, Chile, Argentina & Uruguay | 06-07 (1)<br>07-08 (2)<br>08-10 (4)<br>10-11 (3)<br>11-13 (2)<br>13-15 (3)<br>15-17 (4)<br>17-18 (3)<br>18-19 (2)<br>19-20 (1)<br>10-12 (1)** | 06-07 (1)<br>07-08 (3)<br>08-10 (4)<br>10-11 (3)<br>11-13 (2)<br>14-16 (3)<br>16-20 (4)<br>20-21 (2)<br>21-22 (1) | 07-08 (2)<br>08-14 (1)<br>14-16 (2)<br>16-18 (3)<br>18-00 (4)<br>00-02 (3)<br>02-04 (2)<br>04-07 (3) | 19-21 (1)<br>21-04 (2)<br>04-05 (1)<br>21-04 (1)* |

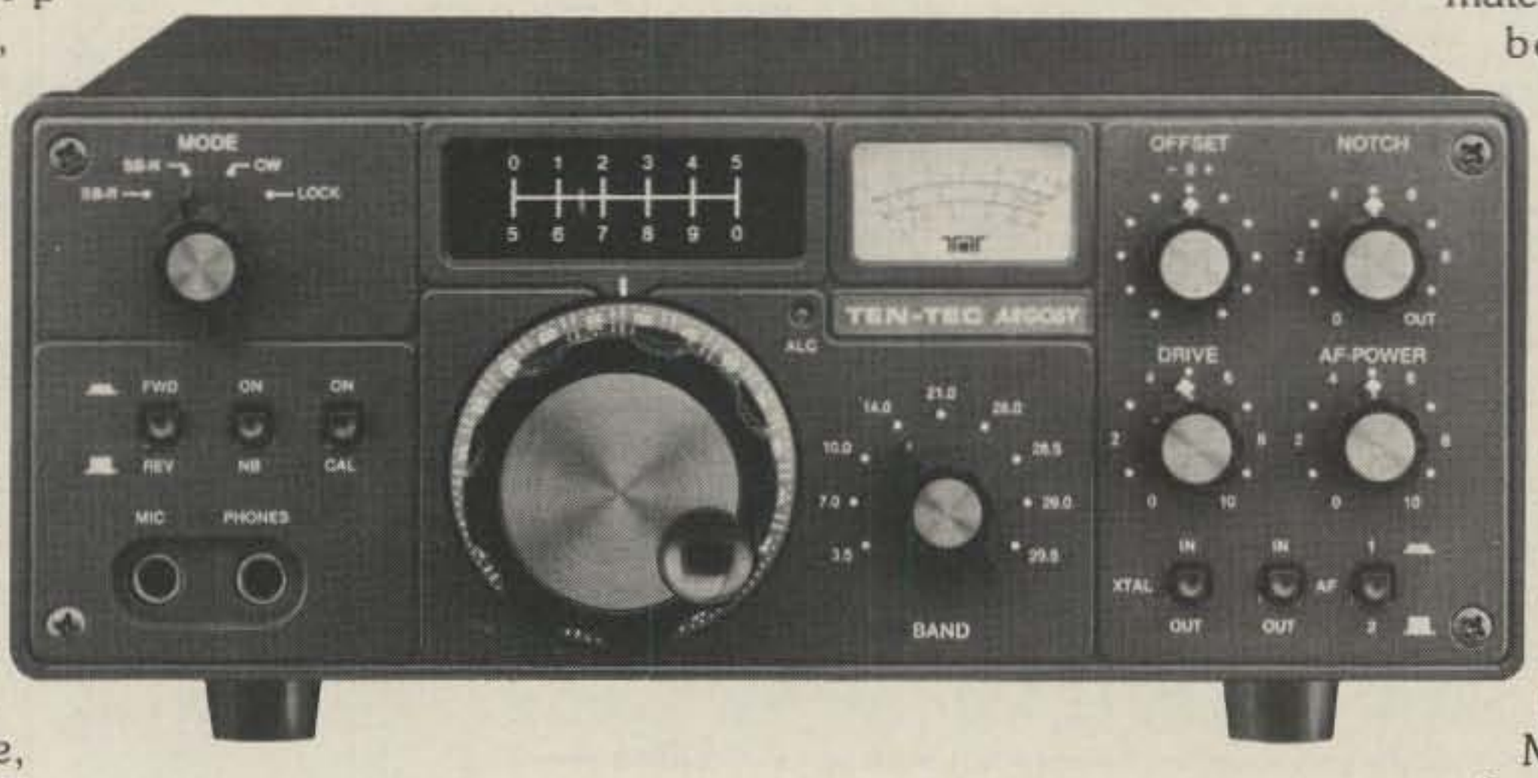
## December 15, 1982-February 15, 1983
## Time Zones: CST & MST
## (24-Hour Time)
## CENTRAL USA TO:

| | *10/6 Meters* | *15 Meters* | *20 Meters* | *40/80 Meters* |
|---|---|---|---|---|
| Western & Southern Europe & North Africa | 07-08 (1)<br>08-09 (3)<br>09-11 (4)<br>11-12 )2)<br>12-13 (1)<br>08-10 (1)** | 06-07 (1)<br>07-08 (2)<br>08-12 (4)<br>12-13 (2)<br>13-14 (1) | 02-06 (1)<br>06-07 (2)<br>07-09 (3)<br>09-11 (2)<br>11-13 (3)<br>13-15 (4)<br>15-17 (3)<br>17-19 (2)<br>19-23 (1)<br>23-02 (2) | 15-17 (1)<br>17-18 (1)<br>18-01 (3)<br>01-02 (2)<br>02-03 (1)<br>17-20 (1)*<br>20-01 (2)*<br>01-02 (1)* |
| Northern & Central Europe & European USSR | 07-08 (1)<br>08-09 (2)<br>09-10 (3)<br>10-11 (2)<br>11-12 (1) | 06-07 (1)<br>07-08 (2)<br>08-10 (4)<br>10-11 (3)<br>11-12 (2)<br>12-13 (1) | 04-07 (1)<br>07-09 (3)<br>09-13 (2)<br>13-15 (3)<br>15-16 (4)<br>16-18 (3)<br>18-20 (2)<br>20-22 (1)<br>22-01 (2)<br>01-02 (1) | 17-19 (1)<br>19-22 (2)<br>22-01 (1)<br>19-00 (1)* |
| Eastern Mediterranean & Middle East | 08-09 (1)<br>09-10 (2)<br>10-11 (3)<br>11-12 (2)<br>12-13 (1) | 07-08 (1)<br>08-10 (3)<br>10-11 (4)<br>11-12 (2)<br>12-13 (1) | 07-10 (1)<br>10-13 (2)<br>13-15 (3)<br>15-17 (4)<br>17-18 (3)<br>18-19 (2)<br>19-21 (1)<br>21-23 (2)<br>23-01 (1) | 18-20 (1)<br>20-22 (2)<br>22-23 (1)<br>20-22 (1)* |
| Western Africa | 07-08 (1)<br>08-09 (2)<br>09-11 (3)<br>11-14 (4)<br>14-16 (3)<br>15-17 (2)<br>17-18 (1)<br>09-11 (1)* | 06-08 (1)<br>08-10 (2)<br>10-14 (3)<br>14-17 (4)<br>17-18 (3)<br>18-20 (2)<br>20-21 (1) | 06-13 (1)<br>13-15 (2)<br>15-17 (3)<br>17-21 (4)<br>21-23 (3)<br>23-01 (2)<br>01-03 (1)<br>03-06 (2) | 18-20 (1)<br>20-23 (2)<br>23-02 (1)<br>20-23 (1)* |
| Eastern & Central Africa | 07-08 (1)<br>08-09 (2)<br>09-13 (3)<br>13-14 (4)<br>14-15 (3)<br>15-16 (2)<br>16-17 (1)<br>10-12 (1)** | 06-08 (1)<br>08-12 (2)<br>12-14 (3)<br>14-16 (4)<br>16-17 (3)<br>17-18 (2)<br>18-19 (1) | 07-14 (1)<br>14-16 (2)<br>16-17 (3)<br>17-20 (4)<br>20-22 (3)<br>22-00 (2)<br>00-02 (1) | 19-00 (1)<br>20-22 (1)* |
| Southern Africa | 07-08 (1)<br>08-09 (2)<br>09-11 (3)<br>11-13 (4)<br>13-14 (3)<br>14-15 (2)<br>15-16 (1)<br>08-10 (1)** | 07-09 (1)<br>09-11 (2)<br>11-12 (3)<br>12-15 (4)<br>15-17 (3)<br>17-18 (2)<br>18-19 (1) | 06-13 (1)<br>13-15 (2)<br>15-17 (3)<br>17-19 (4)<br>19-22 (3)<br>22-01 (2)<br>01-03 (1) | 18-19 (1)<br>19-21 (2)<br>21-22 (1)<br>19-21 (1)* |
| Central & South Asia | 08-09 (1)<br>09-10 (2)<br>10-11 (1)<br>18-19 (1)<br>19-20 (2)<br>20-21 (1) | 07-08 (1)<br>08-10 (2)<br>10-11 (1)<br>18-19 (1)<br>19-21 (2)<br>21-22 (1) | 04-06 (1)<br>06-07 (2)<br>07-09 (3)<br>09-10 (2)<br>10-11 (1)<br>17-18 (1)<br>18-19 (2)<br>19-21 (3)<br>21-23 (2)<br>23-02 (1) | 06-08 (1)<br>18-20 (1) |
| Southeast Asia | 09-10 (1)<br>10-13 (2)<br>13-14 (1)<br>16-17 (1)<br>17-19 (3)<br>19-20 (2)<br>20-21 (1) | 08-09 (1)<br>09-10 (2)<br>10-12 (3)<br>12-13 (2)<br>13-14 (1)<br>16-18 (1)<br>18-20 (3)<br>20-21 (2)<br>21-22 (1) | 06-07 (1)<br>07-09 (2)<br>09-10 (3)<br>10-12 (2)<br>12-14 (1)<br>16-18 (1)<br>18-20 (2)<br>20-21 (3)<br>21-22 (2)<br>22-23 (1) | 04-07 (1)<br>17-19 (1) |
| Far East | 15-16 (1)<br>16-17 (2)<br>17-19 (4)<br>19-20 (2)<br>20-21 (1)<br>17-19 (1)* | 08-10 (1)<br>15-16 (1)<br>16-17 (2)<br>17-19 (4)<br>19-20 (3)<br>20-21 (2)<br>21-22 (1) | 02-03 (2)<br>03-06 (1)<br>06-07 (2)<br>07-09 (3)<br>09-10 (2)<br>10-11 (1)<br>15-18 (1)<br>18-20 (2)<br>20-22 (3) | 02-03 (1)<br>03-07 (2)<br>07-09 (1)<br>03-07 (1)* |
| South Pacific & New Zealand | 09-11 (1)<br>11-14 (2)<br>14-15 (3)<br>15-18 (4)<br>18-19 (3)<br>19-20 (2)<br>20-21 (1)<br>16-18 (1)** | 07-09 (1)<br>09-11 (2)<br>11-13 (3)<br>13-16 (2)<br>16-17 (3)<br>17-19 (4)<br>19-21 (3)<br>21-22 (2)<br>22-23 (1) | 10-17 (1)<br>17-19 (2)<br>19-20 (3)<br>20-00 (4)<br>00-04 (3)<br>04-06 (2)<br>06-07 (3)<br>07-08 (4)<br>08-09 (3)<br>09-10 (2) | 23-01 (1)<br>01-02 (2)<br>02-07 (3)<br>07-08 (2)<br>08-09 (1)<br>00-02 (1)*<br>02-07 (2)*<br>07-08 (1)* |
| McMurdo Sound, Antarctica | 08-10 (1)<br>17-19 (1) | 06-09 )1)<br>15-17 (1)<br>17-18 (2)<br>18-20 (3)<br>20-22 (2)<br>22-23 (1) | 17-20 (1)<br>20-21 (2)<br>21-00 (3)<br>00-02 (2)<br>02-04 (3)<br>04-05 (2)<br>05-06 (1)<br>06-08 (2)<br>08-09 (1) | 00-06 (1) |



Say You Saw It In CQ

# Here's a Concept You Haven't Seen In Amateur Radio For A Long Time— Low Price.




**The right design — for all the right reasons.** In setting forth design parameters for ARGOSY, Ten-Tec engineers pursued the goal of giving amateurs a rig with the right features at a price that stops the amateur radio price spiral.

The result is a unique new transceiver with selectable power levels (convertible from 10 watts to 100 watts at the flick of a switch), a rig with the right bands (80 through 10 meters including the new 30 meter band), a rig with the right operational features plus the right options, and the right price for today's economy—just $549.

**Low power or high power,** ARGOSY has it. Now you can enjoy the sport and challenge of QRPp operating, and, when you need it, the power to stand up to the crowds in QRM and poor band conditions. Just flip a switch to move from true QRPp power with the correct bias voltages to a full 100 watt input.

**New analog readout design.** Fast, easy, reliable, and efficient. The modern new readout on the ARGOSY is a mechanical design that instantly gives you all significant figures of any frequency. Right down to five figures (± 2 kHz). The band switch indicates the first two figures (MHz), the linear scale with lighted red bar-pointer indicates the third figure (hundreds) and the tuning knob skirt gives you the fourth and fifth figures (tens and units). Easy. And efficient—so battery operation is easily achieved.

**The right receiver features.** ***Sensitivity*** of 0.3 μV for 10 dB S+N/N. ***Selectivity:*** the standard 4-pole crystal filter has 2.5 kHz bandwidth and a 2.7:1 shape factor at 6/50 dB. Other cw and ssb filters are available as options, see below. I-f frequency is 9 MHz, i-f rejection 60 dB. ***Offset tuning*** is ± 3 kHz with a detent zero position in the center. ***Built-in notch filter*** has a better than 50 dB rejection notch, tunable from 200 Hz to 3.5 kHz. An optional noise blanker of the i-f type has 50 dB blanking range. ***Built-in speaker*** is powered by low-distortion audio (less than 2% THD)

**The right transmitter features.** ***Frequency coverage*** from 80 through 10 meters, including the new 30 meter band, in nine 500 kHz segments (four segments for 10 meters), with approximately 40 kHz VFO overrun on each band edge. ***Convertible power:*** 100 or 10 watts input with 100% duty cycle for up to 20 minutes on all bands. ***3-function meter*** shows forward peak power on transmit, SWR, and received signal strength. ***PTT*** on ssb, ***full break-in*** on cw. PIN diode antenna switch. ***Built-in cw sidetone*** with variable pitch and volume. ***ALC control*** on "high" power only where needed, with LED indicator. ***Automatic*** normal sideband selection plus reverse. ***Normal 12-14V dc*** operation plus ac operation with optional power supply.

**The right styling, the right size.** Easy-to-use controls, fast-action push buttons, all located on raised front panel sections. New meter with lighted, easy-to-read scales. Rigid steel chassis, molded front panel with matching aluminum top, bottom and back. Stainless steel tilt-up bail. And it's only 4" high by 9½" wide by 12" deep (bail not extended) to go anywhere, fit anywhere at home, in the field, car, plane or boat.

**The right accessories**—all front-panel switchable. Model 220 2.4 kHz 8-pole ssb filter $55; Model 218 1.8 kHz 8 pole ssb filter $55; Model 217 500 Hz cw filter $55; Model 219 250 Hz cw filter $55; Model 224 Audio cw filter $34; Model 223 Noise blanker $34; Model 226 internal Calibrator $39; Model 1125 Dc circuit breaker $15; Model 225 117/230V ac power supply $129; Model 222 mobile mount, $25; Model 1126 linear switching kit, $15.

## New TEN-TEC Argosy $549

**Model 525 ARGOSY —— $549.** Make the right choice, ARGOSY—for the right reasons ***and*** low price. See your TEN-TEC dealer or write.

TEN-TEC, INC.
SEVIERVILLE, TENNESSEE 37862

| | | | | |
|---|---|---|---|---|
| Australasia | 08-09 (1)<br>09-11 (2)<br>11-14 (1)<br>14-16 (2)<br>16-17 (3)<br>17-19 (4)<br>19-20 (3)<br>20-21 (2)<br>21-22 (1)<br>17-19 (1)** | 07-08 (1)<br>08-09 (2)<br>09-10 (3)<br>10-11 (2)<br>11-13 (1)<br>13-17 (2)<br>17-19 (3)<br>19-21 (4)<br>21-22 (2)<br>22-23 (1) | 04-07 (2)<br>07-09 (4)<br>09-10 (3)<br>10-11 (2)<br>11-15 (1)<br>15-17 (2)<br>17-20 (1)<br>20-23 (2)<br>23-04 (3) | 02-04 (1)<br>04-07 (2)<br>07-09 (1)<br>03-06 (1)* |
| Caribbean, Central America & Northern Countries of South America | 07-08 (1)<br>08-09 (3)<br>09-11 (4)<br>11-13 (3)<br>13-16 (4)<br>16-17 (3)<br>17-18 (2)<br>18-19 (1)<br>09-11 (1)** | 06-07 (1)<br>07-08 (3)<br>08-11 (4)<br>11-13 (3)<br>13-18 (4)<br>18-19 (3)<br>19-21 (2)<br>21-22 (1) | 06-07 (3)<br>07-09 (4)<br>09-11 (3)<br>11-14 (2)<br>14-16 (3)<br>16-23 (4)<br>23-02 (3)<br>02-06 (2) | 17-18 (1)<br>18-19 (2)<br>19-21 (3)<br>21-04 (4)<br>04-05 (2)<br>05-07 (1)<br>19-20 (1)*<br>20-22 (2)*<br>22-01 (3)*<br>01-02 (2)*<br>02-04 (1)* |
| Peru, Bolivia, Paraguay, Brazil, Chile, Argentina & Uruguay | 06-07 (1)<br>07-08 (2)<br>08-10 (4)<br>10-11 (3)<br>11-13 (2)<br>13-14 (3)<br>14-17 (4)<br>17-18 (3)<br>18-19 (2)<br>19-20 (1)<br>09-11 (1)** | 06-07 (1)<br>07-08 (3)<br>08-10 (4)<br>10— (3)<br>11-13 (2)<br>13-15 (3)<br>15-20 (4)<br>20-21 (3)<br>21-22 (2)<br>22-23 (1) | 02-06 (2)<br>06-07 (3)<br>07-08 (2)<br>08-14 (1)<br>14-16 (2)<br>16-18 (3)<br>18-00 (4)<br>00-02 (3) | 19-21 (1)<br>21-04 (2)<br>04-06 (1)<br>21-05 (1)* |
| McMurdo Sound, Antarctica | 08-10 (1) | 06-08 (1)<br>08-10 (2)<br>10-12 (1)<br>15-17 (1)<br>17-18 (2)<br>18-22 (3)<br>22-23 (2)<br>23-00 (1) | 16-18 (1)<br>18-20 (2)<br>20-02 (3)<br>02-04 (2)<br>04-06 (1)<br>06-08 (2)<br>08-09 (1) | 23-05 (1) |

## Time Zone: PST (24-Hour Time) WESTERN USA TO:

| | *10/6 Meters* | *15 Meters* | *20 Meters* | *40/80 Meters* |
|---|---|---|---|---|
| Western & Southern Europe & North Africa | 06-07 (1)<br>07-08 (2)<br>08-10 (3)<br>10-11 (2)<br>11-12 (1) | 06-07 (1)<br>07-08 (2)<br>08-09 (3)<br>09-11 (4)<br>11-12 (2)<br>12-13 (1) | 05-06 (1)<br>06-09 (2)<br>09-12 (3)<br>12-14 (4)<br>14-15 (3)<br>15-17 (2)<br>17-19 (1)<br>22-01 (2) | 18-20 (1)<br>21-00 (2)<br>00-01 (1)<br>19-23 (1)* |
| Central & Northern Europe & European USSR | 07-08 (1)<br>08-10 (2)<br>10-11 (1) | 06-07 (1)<br>07-08 (2)<br>08-10 (3)<br>10-11 (2)<br>11-12 (1) | 05-06 (1)<br>06-07 (2)<br>07-09 (3)<br>09-11 (2)<br>11-14 (1)<br>14-16 (3)<br>16-18 (2)<br>18-21 (1)<br>21-00 (2) | 18-20 (1)<br>20-23 (2)<br>23-00 (1)<br>19-22 (1)* |

| | | | | |
|---|---|---|---|---|
| Eastern Mediterranean & Middle East | 07-08 (1)<br>08-10 (2)<br>10-11 (1) | 06-07 (1)<br>07-08 (2)<br>08-10 (3)<br>10-11 (2)<br>11-12 (1) | 06-07 (1)<br>07-10 (2)<br>10-14 (1)<br>14-16 (3)<br>16-17 (2)<br>17-20 (1)<br>20-23 (2) | 07-09 (1)<br>18-22 (1) |
| Western Africa | 07-08 (1)<br>08-09 (2)<br>09-11 (3)<br>11-13 (4)<br>13-15 (3)<br>15-16 (2)<br>16-17 (1)<br>09-11 (1)** | 06-07 (1)<br>07-08 (2)<br>08-13 (3)<br>13-16 (4)<br>16-17 (3)<br>17-18 (2)<br>18-19 (1) | 05-12 (1)<br>12-14 (2)<br>14-16 (3)<br>16-19 (4)<br>19-22 (3)<br>22-00 (2)<br>00-02 (1) | 18-19 (1)<br>19-21 (2)<br>21-22 (1)<br>19-21 (1)* |
| Eastern & Central Africa | 07-08 (1)<br>08-10 (2)<br>10-13 (3)<br>13-14 (2)<br>14-15 (1)<br>09-11 (1)** | 06-08 (1)<br>08-12 (2)<br>12-15 (3)<br>15-17 (2)<br>17-18 (1) | 06-07 (1)<br>07-09 (2)<br>09-14 (1)<br>14-16 (2)<br>16-21 (3)<br>21-23 (2)<br>23-00 (1) | 18-22 (1)<br>07-09 (1) |
| Southern Africa | 07-08 (1)<br>08-10 (3)<br>10-12 (4)<br>12-13 (3)<br>13-14 (2)<br>14-15 (1)<br>08-10 (1)** | 07-09 (1)<br>09-12 (2)<br>12-13 (3)<br>13-15 (4)<br>15-17 (2)<br>17-18 (1) | 06-07 (1)<br>07-09 (2)<br>09-12 (1)<br>12-14 (2)<br>14-16 (3)<br>16-18 (4)<br>18-20 (3)<br>20-00 (2)<br>00-02 (1) | 18-19 (1)<br>19-20 (2)<br>20-21 (1)<br>18-19 (1)* |
| Central & South Asia | 06-09 (1)<br>17-18 (1)<br>18-19 (3)<br>19-20 (1) | 06-09 (1)<br>16-17 (1)<br>17-19 (3)<br>19-20 (2)<br>20-21 (1) | 06-07 (1)<br>07-09 (2)<br>09-11 (1)<br>16-17 (1)<br>17-18 (2)<br>18-19 (3)<br>19-21 (2)<br>21-23 (1) | 04-09 (1)<br>17-19 (1) |
| Southeast Asia | 08-09 (1)<br>09-11 (2)<br>11-12 (1)<br>14-15 (1)<br>15-16 (3)<br>16-18 (4)<br>18-19 (3)<br>19-20 (2)<br>20-21 (1)<br>15-17 (1)** | 07-08 (1)<br>08-10 (3)<br>10-11 (2)<br>11-14 (1)<br>14-15 (2)<br>15-18 (3)<br>18-20 (2)<br>20-21 (3)<br>21-22 (1) | 06-07 (1)<br>07-08 (2)<br>08-10 (3)<br>10-11 (2)<br>11-12 (1)<br>15-17 (1)<br>19-20 (1)<br>20-22 (2)<br>22-00 (1) | 02-04 (1)<br>04-07 (2)<br>07-08 (1)<br>04-06 (1)* |
| Far East | 13-14 (1)<br>14-15 (2)<br>15-16 (3)<br>16-18 (4)<br>18-19 (3)<br>19-20 (2)<br>20-21 (1)<br>15-18 (1)** | 12-14 (1)<br>14-15 (3)<br>15-17 (2)<br>17-19 (4)<br>19-20 (3)<br>20-21 (2)<br>21-22 (1) | 00-06 (2)<br>06-08 (3)<br>08-09 (2)<br>09-12 (1)<br>12-18 (2)<br>18-21 (4)<br>21-22 (3)<br>22-00 (2) | 00-01 (1)<br>01-04 (2)<br>04-07 (3)<br>07-08 (1)<br>01-05 (1)*<br>05-06 (2)*<br>06-07 (1)* |
| South Pacific & New Zealand | 09-10 (1)<br>10-11 (2)<br>11-13 (4)<br>13-16 (3)<br>16-19 (4)<br>19-20 (2)<br>20-21 (1)<br>15-18 (1)** | 07-08 (1)<br>08-09 (2)<br>09-11 (4)<br>11-15 (2)<br>15-17 (3)<br>17-22 (4)<br>22-23 (3)<br>23-00 (2)<br>00-01 (1) | 04-07 (1)<br>07-09 (4)<br>09-10 (3)<br>10-11 (2)<br>11-18 (1)<br>18-19 (2)<br>19-20 (3)<br>20-00 (4)<br>00-02 (3)<br>02-04 (2) | 21-22 (1)<br>22-00 (2)<br>00-07 (3)<br>07-08 (2)<br>08-09 (1)<br>22-00 (1)*<br>00-06 (2)*<br>06-07 (1)* |
| Australasia | 10-13 (1)<br>13-15 (2)<br>15-16 (3)<br>17-19 (4)<br>19-20 (3)<br>20-21 (2)<br>21-22 (1)<br>17-19 (1)** | 08-09 (1)<br>09-11 (3)<br>11-12 (2)<br>12-14 (3)<br>14-15 (2)<br>15-17 (1)<br>17-19 (2)<br>19-21 (4)<br>21-22 (2)<br>22-23 (1) | 06-07 (3)<br>07-09 (4)<br>09-10 (3)<br>10-12 (2)<br>12-14 (1)<br>18-20 (1)<br>20-21 (2)<br>21-23 (3)<br>23-01 (4)<br>01-03 (3)<br>03-04 (2)<br>04-05 (1) | 01-03 (1)<br>03-04 (2)<br>04-07 (3)<br>07-08 (1)<br>03-04 (1)*<br>04-06 (2)*<br>06-07 (1)* |
| Carribbean, Central America & Northern Countries of South America | 07-08 (1)<br>08-09 (3)<br>09-10 (4)<br>10-12 (3)<br>12-15 (4)<br>15-16 (3)<br>16-17 (2)<br>17-18 (1)<br>08-10 (1)** | 06-07 (1)<br>07-08 (3)<br>08-10 (4)<br>10-13 (3)<br>13-18 (4)<br>18-19 (3)<br>19-20 (2)<br>20-21 (1) | 06-08 (4)<br>08-10 (3)<br>10-13 (2)<br>13-15 (3)<br>15-22 (4)<br>22-00 (3)<br>00-06 (2) | 17-18 (1)<br>18-19 (2)<br>19-20 (3)<br>20-04 (4)<br>04-05 (2)<br>05-06 (1)<br>19-20 (1)*<br>20-22 (2)*<br>22-00 (3)*<br>00-03 (2)*<br>03-05 (1)* |
| Peru, Bolivia, Paraguay, Brazil, Chile, Argentina & Uruguay | 06-07 (1)<br>07-08 (2)<br>08-09 (4)<br>09-10 (3)<br>10-12 (2)<br>12-13 (3)<br>13-16 (4)<br>16-17 (3)<br>17-18 (2)<br>18-19 (1)<br>08-11 (1)** | 06-07 (1)<br>07-08 (3)<br>08-09 (4)<br>09-11 (3)<br>11-13 (2)<br>13-15 (3)<br>15-19 (4)<br>19-20 (3)<br>20-21 (2)<br>21-22 (1) | 05-06 (2)<br>06-07 (3)<br>07-08 (2)<br>08-14 (1)<br>14-16 (2)<br>16-18 (3)<br>18-00 (4)<br>00-01 (3)<br>01-03 (2)<br>03-05 (1) | 19-20 (1)<br>20-22 (2)<br>22-00 (1)<br>00-04 (2)<br>04-05 (1)<br>20-03 (1)* |
| McMurdo Sound, Antarctica | 07-08 (1)<br>08-09 (2)<br>09-10 (1)<br>19-20 (1)<br>20-21 )2)<br>21-22 (1) | 06-07 (1)<br>07-09 (2)<br>09-11 (1)<br>16-18 (1)<br>18-20 (2)<br>20-22 (3)<br>22-01 (2)<br>01-02 (2) | 16-18 (1)<br>18-20 (2)<br>20-03 (3)<br>03-04 (2)<br>04-05 (1)<br>06-07 (1)<br>07-08 (2)<br>08-10 (1) | 00-05 (1) |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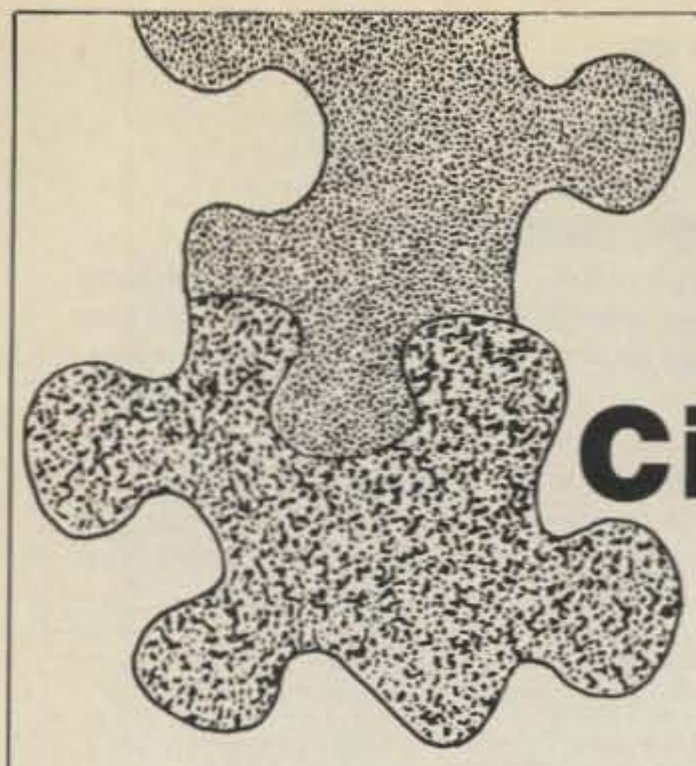
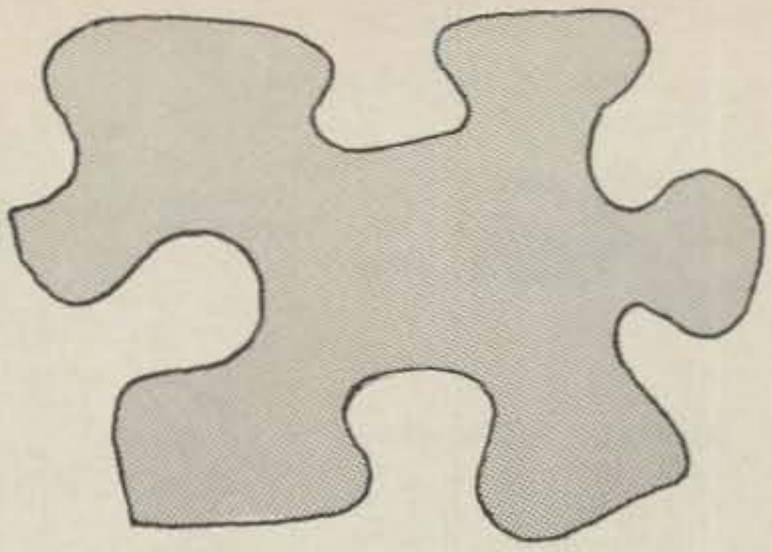


*Get out your thinking caps and spend a few minutes trying to figure this one out.*

# A Resistor Circuit Puzzle



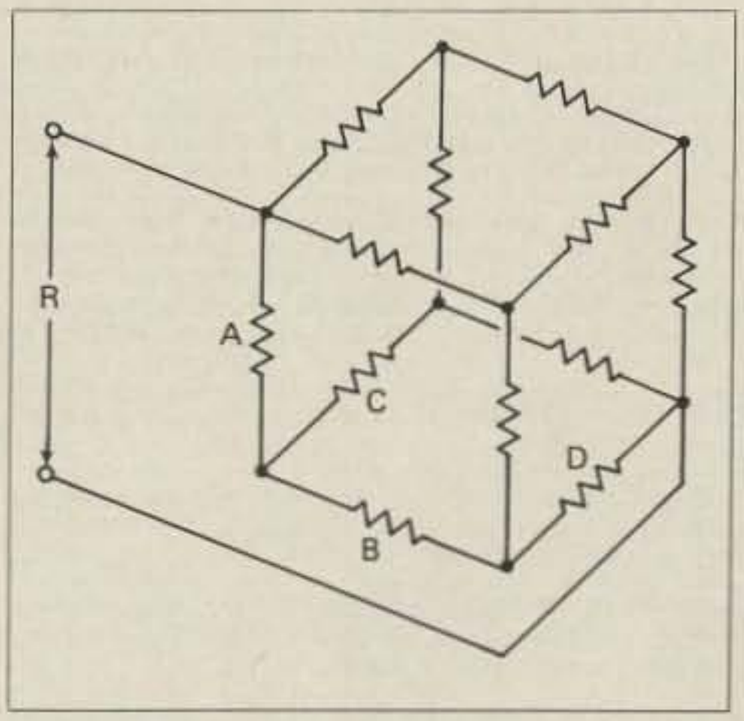
BY PHIL ANDERSON*, W0XI

Can you solve this puzzle in three minutes or less? In the figure, what is the resistance between the two terminals? Assume that each resistor is 1 ohm.

**Hint:** In problems like this, a quick solution can often be had by considering symmetry and/or breaking the problem into smaller segments. The solution is given below, but don't look until you've given it a try.

## Solution

The input series resistor can temporarily be removed so that you can concentrate on the "cube." Then you can combine the series resistor with the "cube" resistance, since they are in series.




Since the cube is symmetrical, current entering at the top will split equally into three resistors. The same is true at the bottom as the currents come out. The current in resistor A then splits again in half through resistors B and C. Hence, the current is 1/3 in A and 1/6 in B and C. So, the voltage across the cube is $1/3 \times 1 + 1/6 \times 1 + 1/3 \times 1$ in resistor D. Hence, the resistance is v/i or 5/6 ohms. Then combining the serial resistor with 5/6, we get the total resistance: $1 + 5/6$. Did you make it?

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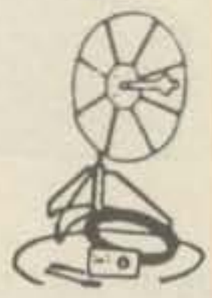

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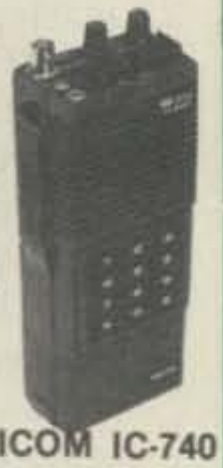

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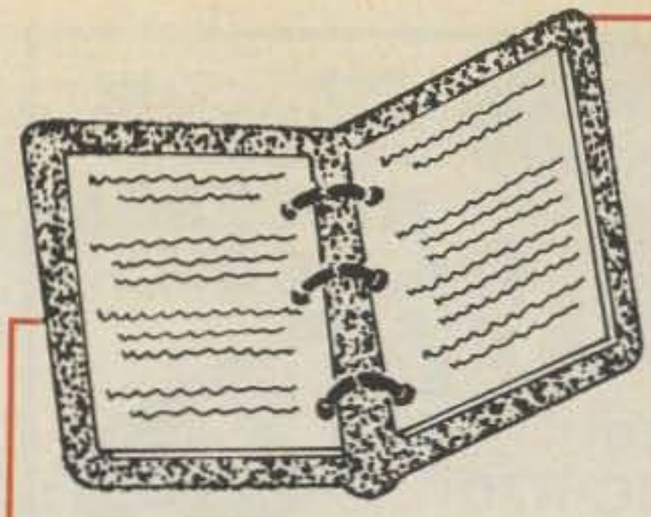

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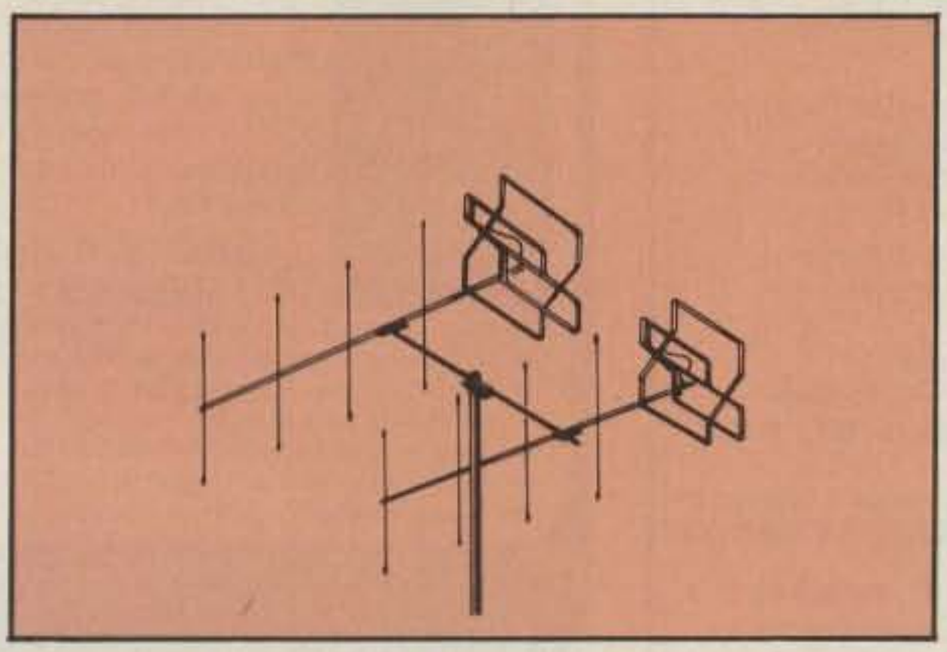

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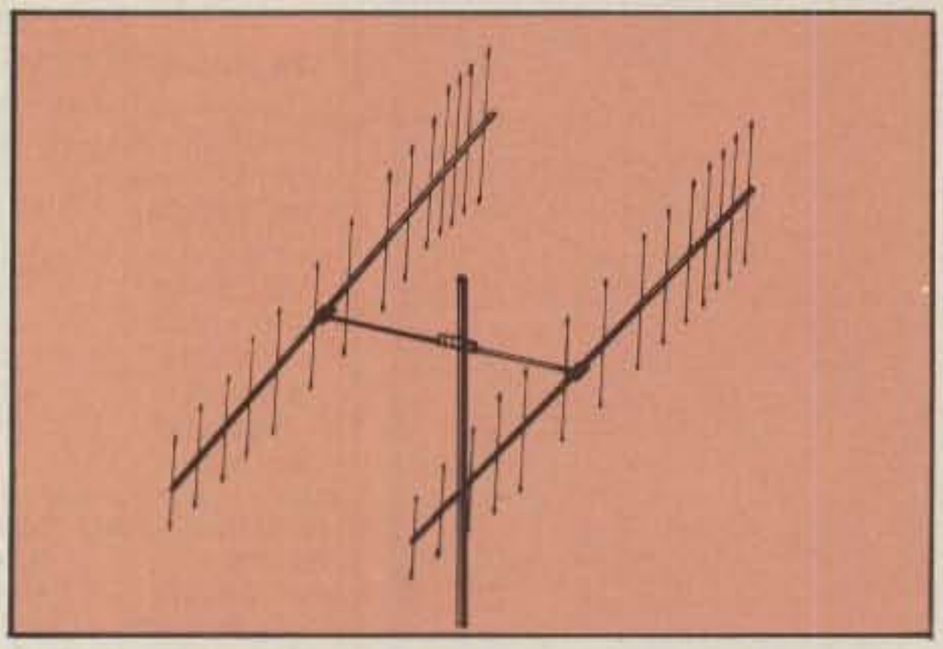

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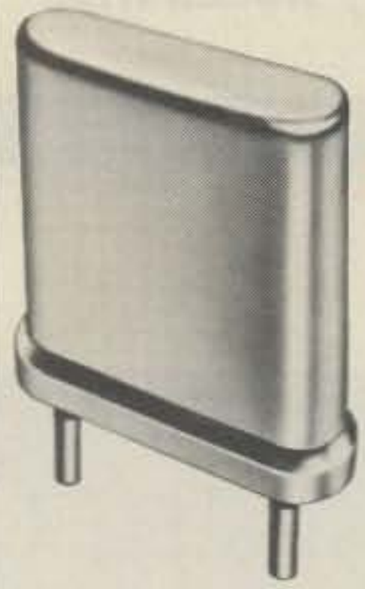

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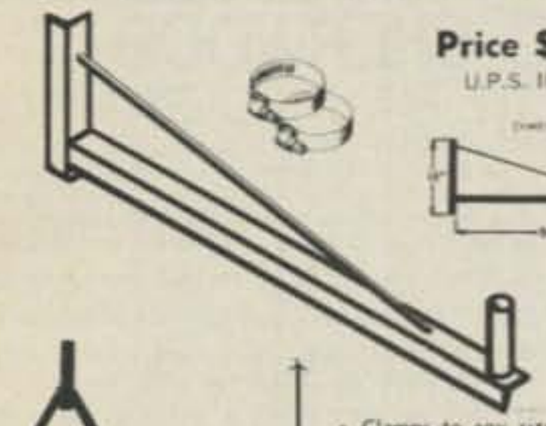

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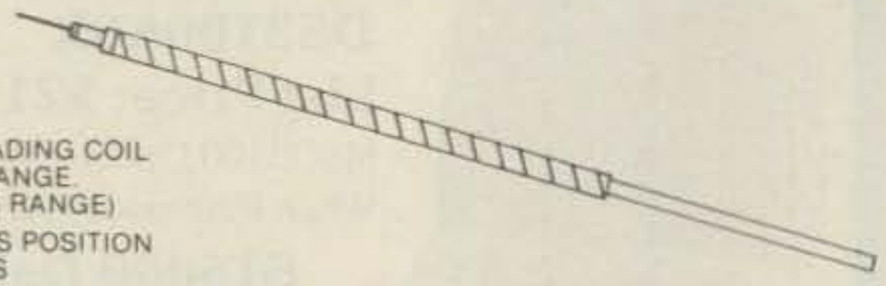

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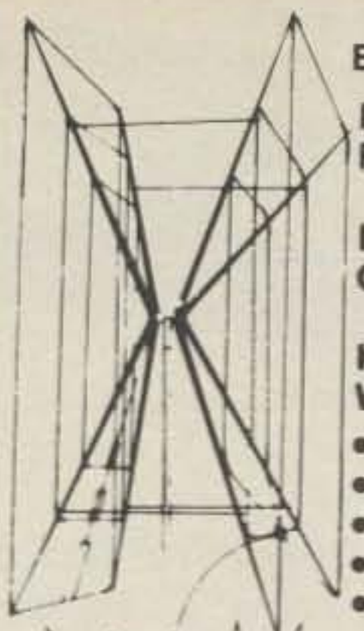

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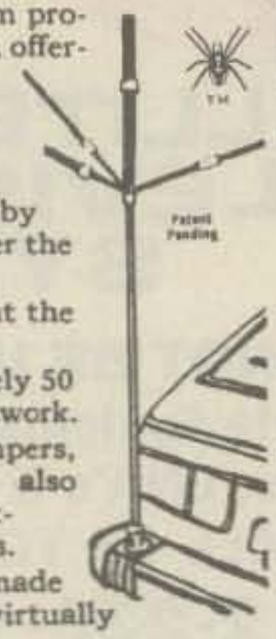


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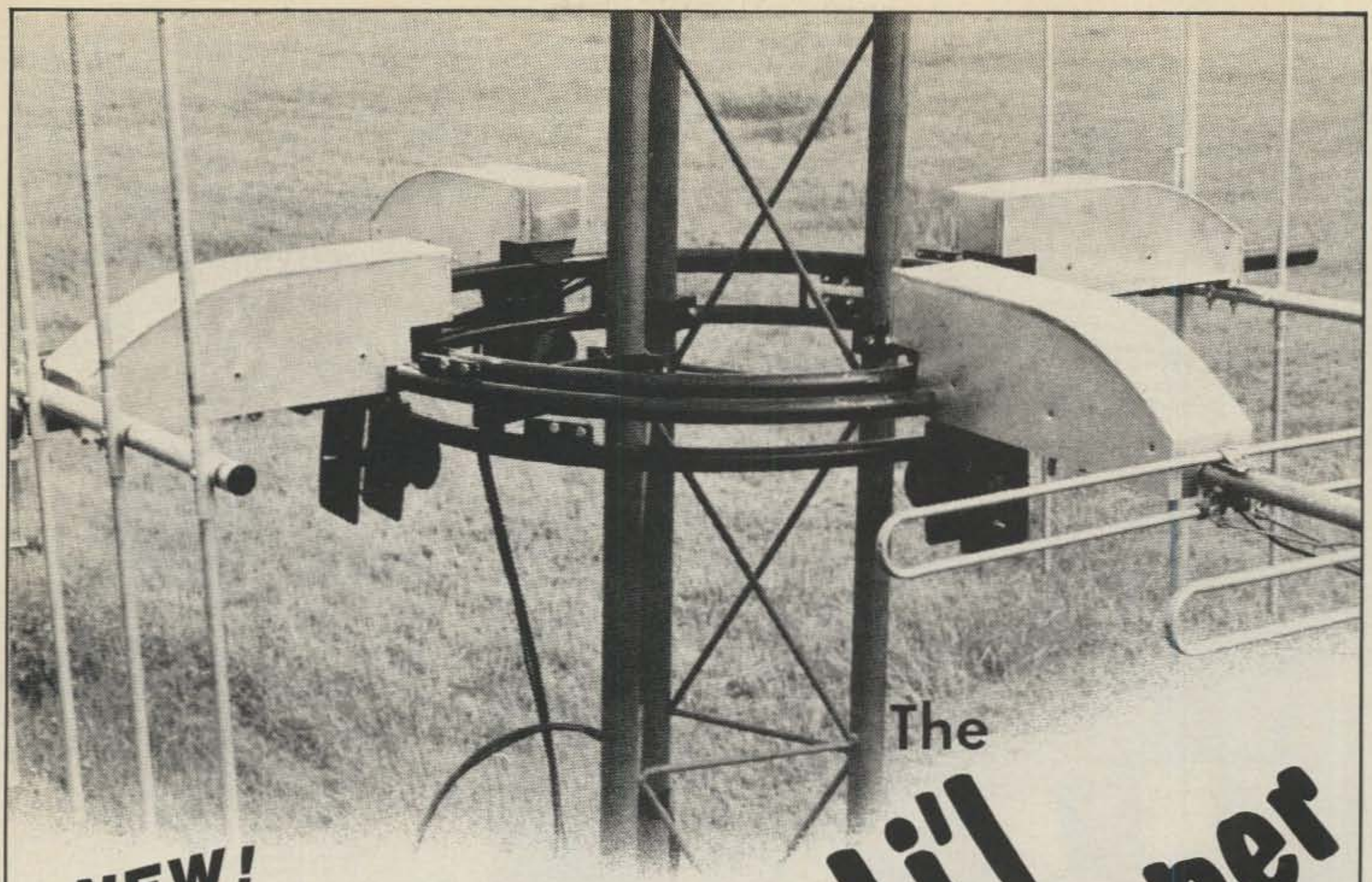

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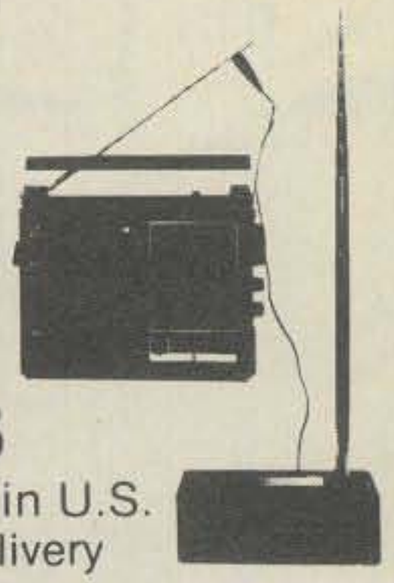

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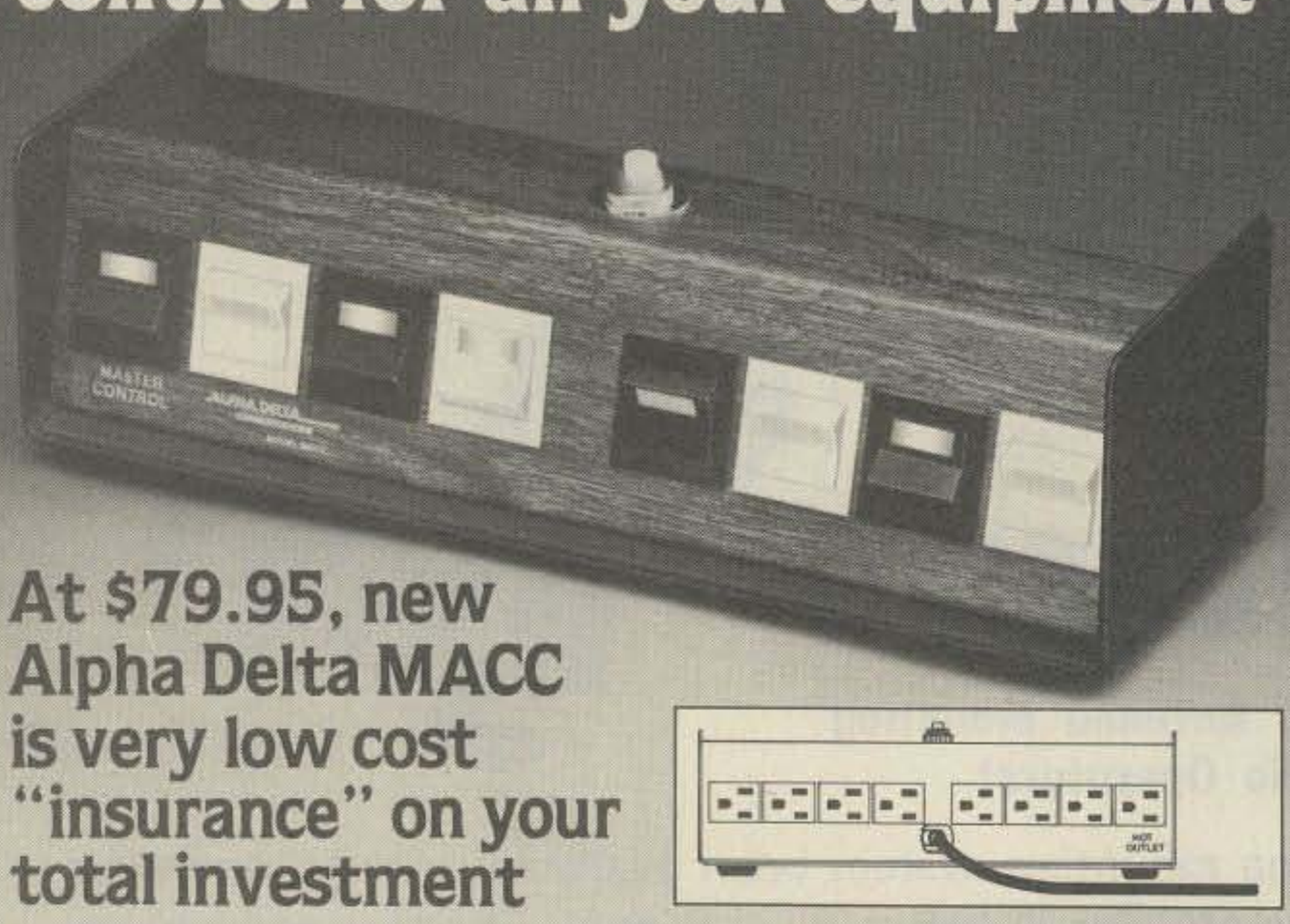


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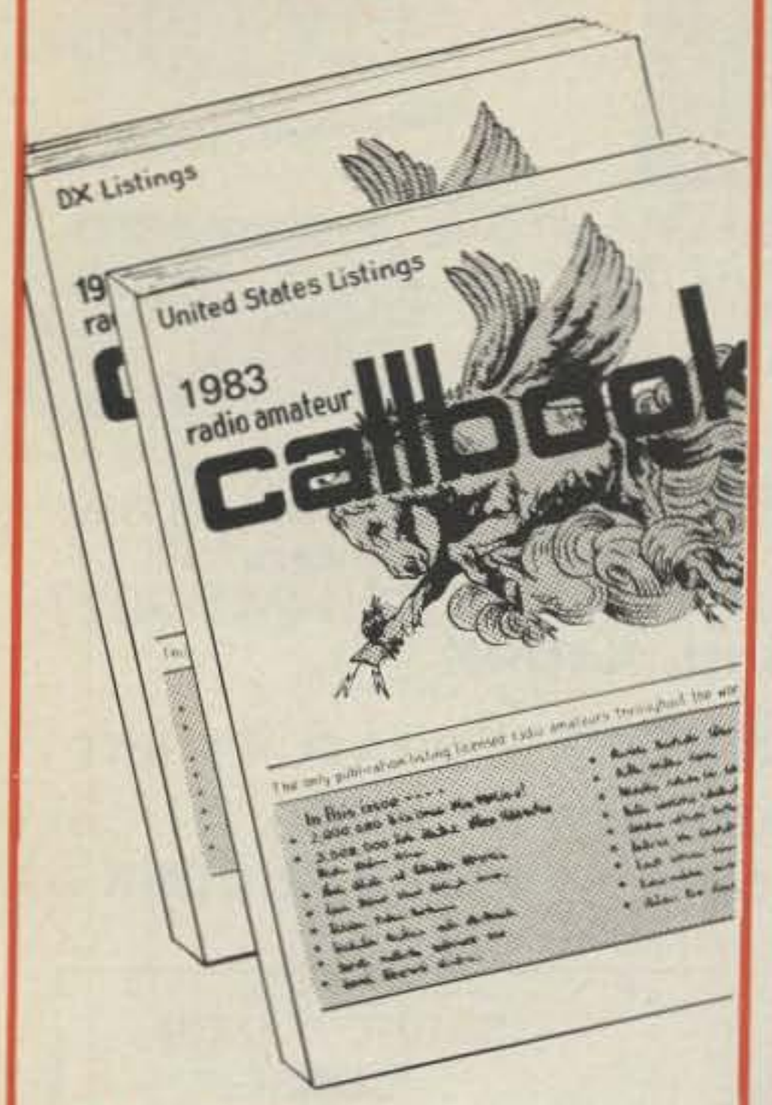


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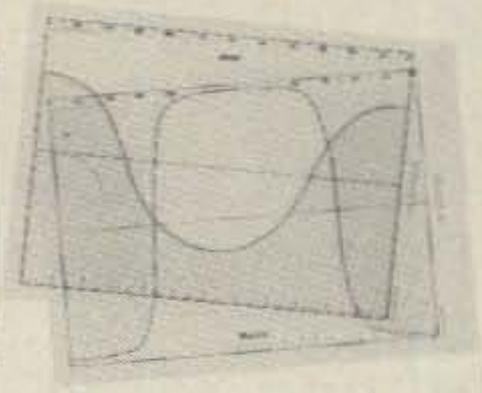

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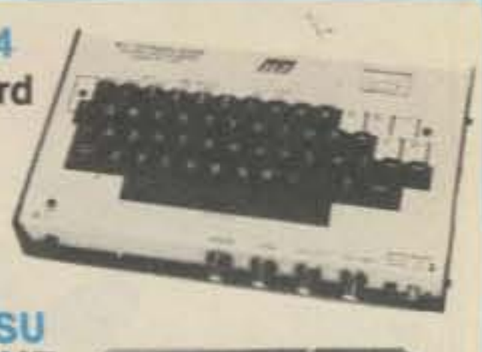

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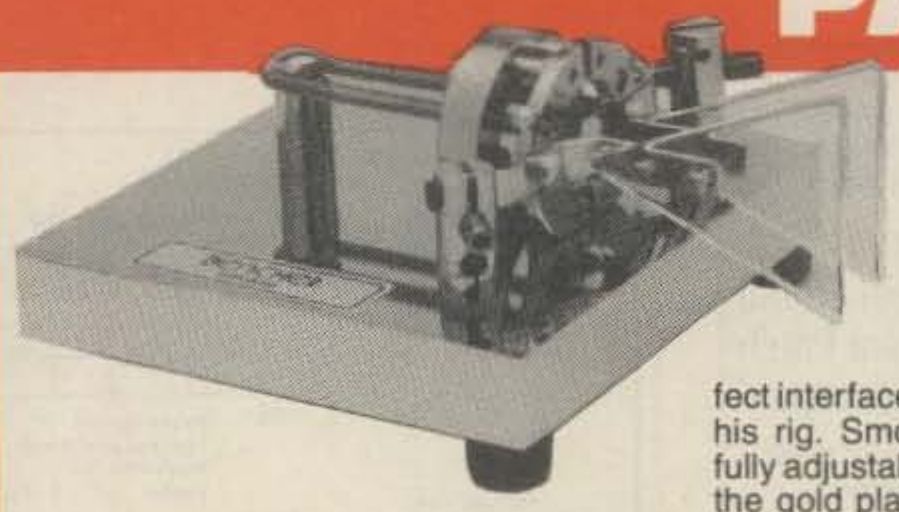

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The FT-ONE is a full-coverage all-mode transceiver, equipped for reception on any frequency between 150 kHz and 29.99 MHz, with transmit coverage on all nine present and proposed amateur bands. In countries where permitted, the FT-ONE may be programmed to transmit throughout the 1.8-29.99 MHz range.

## KEYBOARD FREQUENCY ENTRY

Fully digitally synthesized, the FT-ONE uses a front panel keyboard for initial frequency entry. Frequency change is then accomplished via the main tuning dial or the pushbutton scanner, with tuning in either 10 Hz or 100 Hz steps possible. Truly the contester's dream, the FT-ONE permits extremely fine tuning and instantaneous band change with equal facility.

## DUAL VFO SYSTEM

Ten digital VFO's with memory are provided, in conjunction with an A-B selection scheme that allows instant recall of any transmit, receive, or transceive frequency desired. For split-frequency operation, such as on 7 MHz SSB, the operator may select TX on VFO-A and RX on VFO-B, automatically storing the calling and listening frequencies for each pile-up. For net operations, a non-volatile memory board is available as an option, to eliminate the possibility of dumping memory.

## FULL CW BREAK-IN

Recent advances in solid-state technology have finally made full CW break-in reliable enough to be incorporated into a Yaesu product. Now you can select traditional semi-break-in (for use with amplifiers not equipped for full break-in) or full high-speed break-in. When using amplifiers so equipped, the keyer output lead may be interrupted via a rear panel jack and routed to the break-in sequencing input on your amplifier.

## SWITCHING REGULATOR POWER SUPPLY

Extremely compact and light in weight, the switching regulator power supply reduces substantially the space required to produce the operating voltages used in the FT-ONE. Highly efficient and uniquely stable, the switching regulator supply provides superb reliability in a field of design long neglected by amateur manufacturers.

## ELITE CLASS PERFORMANCE FEATURES

In addition to the full break-in and superb receiver filters, Yaesu's design team packed the FT-ONE with subtle virtues that others might have overlooked. Rear panel jacks allow the use of both an external receiver and an independent receive antenna, such as a 160 meter Beverage. While scanning, automatic halting on a received signal may be programmed. . . perfect for watching a band for openings. If you're a DX-peditioner, an optional Curtis 8044 keyer board is available, so you won't need an external keyer that only wastes suitcase space. And if your amplifier fan is louder than it should be, there's even a microphone squelch (AMGC) to reduce background noise pickup between words and sentences!

## ONE YEAR FACTORY WARRANTY

Because of the level of attention to design detail, parts selection, and factory quality control, your FT-ONE is backed by a one-year *factory* warranty for the original purchaser at retail. Prompt and meticulous attention to your warranty needs will be provided by our Ohio And California Service Centers. In addition, all units sold in the United States will be inspected and tested after clearing Customs, and will include a Service Manual in the puchase price.

## GAIN/INTERCEPT OPTIMIZED RECEIVER FRONT END

Utilizing up-conversion with a first IF of 73 MHz, the FT-ONE RF amplifier stage uses push-pull power transistors configured to produce a typical output intercept of +40 dBm. The first mixer utilizes a diode ring module followed by a low noise post amp, for optimum noise figure consistent with modern day intercept requirements. The result is a receiver with a typical two-tone dynamic range well in excess of 95 dB (14 MHz, CW bandwidth). Additional gain tailoring is provided via a PIN diode attenuator controlled from the front panel.

## FILTERS READY FOR COMPETITION

Three filter bandwidths are available for CW operation (two for FSK!), using optional 600 Hz or 300 Hz crystal filters. Filter insertion losses are equalized for constant IF gain. Both IF Shift and Variable Bandwidth are provided, and two CW filters may be cascaded, for competition-grade selectivity. For SSB work, the Variable Bandwidth feature eliminates the need for costly 1.5 kHz or 1.8 kHz filters, as any intermediate bandwidth may easily be programmed using the standard, cascaded SSB filters. To top it all off, a high-performance audio peak and notch filter is standard equipment.

## EXPANDED OPERATING DISPLAYS

Digital displays for the VFO Frequency, memory channel, and RIT offset are provided for quick frequency identification. The large front panel meter provides easy viewing of transceiver operating parameters, including final transistor collector current, input DC voltage, FM discriminator center tuning, speech processor compression level, and forward/reflected relative power.

## NOT AVAILABLE AS OPTIONS

It's hard to believe that other manufacturers still insist on making such essential items as a noise blanker or speech processor extra-cost options. We find that these are less expensive to incorporate and more reliable in operation when installed on our assembly line. No AC power supply is available as an option for the FT-ONE, either; it's equipped for operation from 100/110/117/200/220/234 volts AC, or 13.5 volts DC. And it goes without saying that there will not be an external VFO offered for the FT-ONE — we're confident that ten VFO's are quite enough!

**Experience the FT-ONE in your Authorized Yaesu Dealer's showroom today.**
**This may be the last Amateur transceiver you will ever own.**

*Warranty policy available upon request. SASE, please.*

*Specifications subject to change without notice or obligation.*

# FT-ONE

## Bold Adventure In Engineering!

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The radio.

1081

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CIRCLE 139 ON READER SERVICE CARD

# IC-R70

NEW!

**The Commercial Grade Communications Receiver that everyone has been asking for.....at a price you can afford!**

## GENERAL COVERAGE RECEPTION AT ITS BEST

Listen to the world of HF with the R70, a 100KHz to 30MHz commercial grade receiver designed by ICOM Incorporated, the leader in advanced receiver design. Built from knowledge gained by designing receivers for commercial, marine, and amateur use, the R70 surpasses other receivers on the market...even receivers costing more than twice as much.

Utilizing ICOM's DFM (Direct Feed Mixer), the R70 is a receiver which in normal usage is virtually immune to intermodulation distortion or cross modulation, yet still maintains superior sensitivity. Whether you are a SWL (short wave listener), Ham (amateur radio operator), maritime operator or commercial user, the R70 provides the features you need.

## DESIGN

The R70 incorporates an UP conversion system, utilizing a direct feed mixer proven to be the best design for minimizing interference from strong adjacent signals. A preamp is provided for making the weakest of signals readable. High grade filters in conjunction with the built-in PBT (pass band tuning) system and notch filter, provide the ultimate in interference rejection. Selectable AGC (fast/slow/off), noise blanker (wide or narrow), and tone control improve readability under the worst conditions. An AGC derived squelch, operative in all modes, adds to operating ease.

Dual VFO's with three tuning rates provide quick QSY (frequency change), memory for an important station, or by equalizing the VFO's (A=B), a digital RIT. 13.8 VDC operation is provided as an option, 117 VAC is standard.

## HAM'ING

The R70 is an ideal general coverage receiver to complement any ham shack. Use it with your existing tramsmitter or transceiver to provide dual receiver capability.

The R70's built-in monitor system lets you listen to your own transmitted audio and a mute input automatically protects the R70's receiver from your signal.

An option for FM allows listening to the 10 meter FM activity.

As an additional plus to ICOM IC-720A owners, the R70 has an optional interface that will allow the R70 to control the transmit frequency of the 720A for the ultimate in hamming versatility.

## SWL'ING

For the short wave listener, the readout section of the R70 gives all the information for logging a station to be returned to at a later time. Frequency, mode, VFO, signal strength are all displayed. A dial lock prevents accidental loss of a signal.

A front mounted speaker provides 3 watts of crisp clear audio. A record jack allows easy attachment of a tape recorder.

## ICOM SYSTEM

Like all ICOM HF products, the R70 fits into the ICOM system concept of accessories allowing you to use previously purchased accessories such as the HP1 headphone, SP3 external speaker, and AH1 auto bandswitching antenna.

## PRICE

Check with your local ICOM dealer for pricing on the R70. You will be amazed.

CIRCLE 75 ON READER SERVICE CARD

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All stated specifications are approximate and subject to change without notice or obligation. All ICOM radios significantly exceed FCC regulations limiting spurious emissions.